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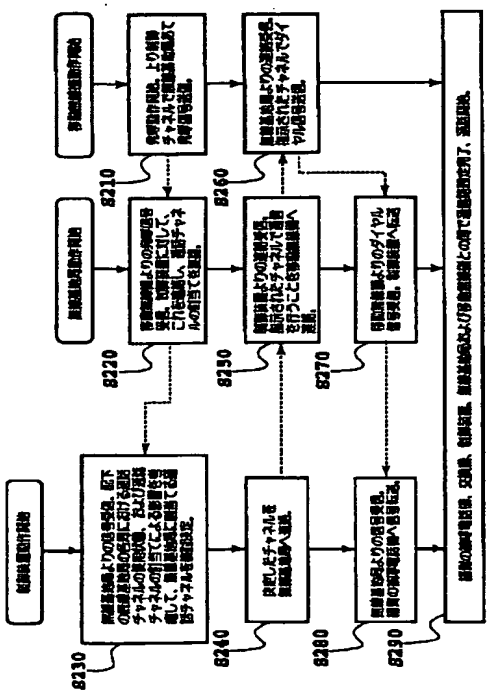
最終頁に続く

(54)【発明の名称】　移動通信システムおよび移動通信システムにおけるチャネル割当て方法

(57)【要約】
【課題】　移動通信システム内の無線基地局間の電波干渉を軽減、あるいは除去し、通信品質の向上を図る。
【解決手段】　移動通信システムの無線基地局の通信に対し、無線基地局間の電波干渉の情報に基づき、該電波干渉が発生しないチャネルを割り当てる。チャネル割当ては、チャネル割当てにより、チャネルを割り当てる無線基地局以外の無線基地局によるチャネル使用に与える影響を考慮して行う。電波干渉が発生しないチャネルがない場合であって、チャネルを割り当てる必要がある場合には、無線基地局間の電波干渉の情報に基づき、発生する電波干渉が小さいチャネルを割り当てる。



【特許請求の範囲】

【請求項１】　複数の無線基地局を備えた移動通信システムであって、前記無線基地局の通信に対し、前記無線基地局間の電波干渉の情報に基づき、該電波干渉が発生しないチャネルを割り当てるチャネル割当て手段を備えたことを特徴とする移動通信システム。

【請求項２】　請求項１に記載の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルがある場合には、該無線チャネル内の任意の通話チャネルを割り当てることを特徴とする移動通信システム。

【請求項３】　請求項１または２に記載の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルはないが、該無線チャネル内に、いずれの無線基地局も使用していない通話チャネルがある場合には、該通話チャネルの内、前記電波干渉が発生しない通話チャネルを割り当てることを特徴とする移動通信システム。

【請求項４】　請求項１ないし３のいずれかに記載の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、各通話チャネルはコードまたは周波数により２以上に多重化可能であり、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルがなく、該無線チャネル内に、割り当てても前記電波干渉が発生しない通話チャネルがない場合には、前記電波干渉が発生しないコードまたは周波数と通話チャネルとの組合せを割り当てることを特徴とする移動通信システム。

【請求項５】　請求項１ないし４のいずれかに記載の移動通信システムにおいて、前記チャネル割当て手段は、チャネル割当てにより、チャネルを割り当てる無線基地局以外の無線基地局によるチャネル使用に与える影響を考慮して割り当てるチャネルを決定することを特徴とする移動通信システム。

【請求項６】　請求項１ないし５のいずれかに記載の移動通信システムにおいて、前記チャネル割当て手段は、前記電波干渉が発生しないチャネルがない場合であって、チャネルを割り当てる必要がある場合には、前記無線基地局間の電波干渉の情報に基づき、発生する前記電波干渉が小さいチャネルを割り当てることを特徴とする移動通信システム。

【請求項７】　請求項１ないし６のいずれかに記載の移動通信システムにおいて、前記無線基地局間の電波干渉の情報は、前記無線基地局間で共通制御チャネルを用いて信号を送受信した場合の電波の受信レベルであることを特徴とする移動通信システム。

【請求項８】　複数の無線基地局を備えた移動通信システムにおけるチャネル割当て方法であって、前記無線基地局の通信に対し、前記無線基地局間の電波干渉の情報に基づき、該電波干渉が発生しないチャネルを割り当てることを特徴とする移動通信システムにおけるチャネル割当て方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、例えば時分割多重化されたデジタル信号を用いる移動通信システムの無線基地局において、通信に使用する通話チャネルが干渉妨害の全く発生しないか、或いは発生量の少ない通話チャネル割当てを実施する方法やシステムに関する。詳しくは、同一システムに属する多数の無線基地局がサービスエリアに多数存在し、近傍にある複数の無線基地局が各々のサービスエリアに存在する移動無線機（移動用の端末には移動無線機の外に携帯電話機、移動データ端末等別の呼称があるが以下移動無線機で総称する）との間で良好な無線通信を行うとき、各無線基地局を総括管理する制御装置で事前に収集記憶した情報をもとに、複数の無線基地局へ同一無線チャネル、同一タイムスロットを同一時間に割当てると干渉妨害を発生する可能性がある。このような干渉妨害を最大限に軽減、ないし除去すると共にシステムの周波数有効利用を図った通話チャネル割当て方法やシステムに関する。

【０００２】

【従来の技術】移動体通信システムは情報通信としてサービスエリアの拡大、利用者（加入者）の急速な拡大が続いている。急激な加入者の増加に対処するためには、周波数の有効利用が必須である。その技術的な解決に信号形式のデジタル化があり、また、一つの無線基地局のサービスエリアを狭くして、場所的に異なるところで周波数の再利用率を高める方法がある。１つの無線基地局のサービスエリアが半径１００メートル程度と極端に狭くしたシステムとして、わが国では例えば１．９ＧＨｚ帯域を使用するデジタルコードレス電話システムがある。このシステム全体の通信容量はかなり大きいことが要求されるが、１無線基地局の支配するサービスエリアを狭小化した結果、１無線基地局当たりの所要通信容量はかなり軽減されることになった。ただし、システムに含まれる所要無線基地局数はかなり多数になったことは当然である。

【０００３】具体的に説明すると、例えば、デジタルコードレス電話システムを例に取る。このシステムの無線基地局は他のセルラーシステムと異なり、無線基地局設置位置が事前に相互干渉のない様に厳密に置局設計されておらず、従って無線基地局相互間の距離間隔は違っており、その結果、隣接する複数の無線基地局へ同一無線チャネル、同一タイムスロットを同一時間に割当てると干渉妨害を発生する可能性がある。

【０００４】しかしながら、システムに割当てられている無線チャネル数が多いため簡易な技術で電波干渉を避けることができ、問題が顕在化することはなかった。それは、通信周波数が３７無線チャネル×４（スロット）＝１４８通信チャネル（８通話チャネルＴＤＭＡ－ＴＤＤ（Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ ＭｕｌｔｉｐｌｅＡｃｃｅｓｓ Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ Ｄｕｐｌｅｘ））を所有しており、一方、１無線基地局当りの通信容量、すなわち、同時に使用される通信トラフィックは４あるいは、８通話チャネル程度で十分であるからである。このために、各無線基地局においては、特に割り当てる通信可能な通話チャネルの制限を行わなくても随時干渉電力を監視し、干渉レベルの低い通話チャネルを通信通話チャネルに割り当てることで良好な通信維持の対応が可能となる。

【０００５】しかしながら、一層の周波数有効利用を図る観点から採用されるデジタル信号形式の１種であるＴＤＭＡ／ＣＤＭＡ（Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ／ Ｃｏｄｅ Ｄｉｖｉｓｉｏｎ ＭｕｌｔｉｐｌｅＡｃｃｅｓｓ）では下記の様な技術上の問題が発生し、解決を迫られることになった。

【０００６】

【発明が解決しようとする課題】時分割多重化されたデジタル信号（ＴＤＭＡ／ＣＤＭＡ）を用いたシステムにおいては、干渉キャンセラ技術の観点から、各基地局にタイムスロット単位で通話チャネルを割り当てることにより、通話チャネル割り当て制御が簡素化でき、かつキャパシティ増大につながる。しかしながら、システム内の無線基地局間距離が必ずしも均一でないことから、同一システム内で干渉となりうる基地局と干渉にならない基地局の判断ができない。従って、上記の様に無差別に割り当てたのでは干渉妨害が発生する可能性が大きくなり良好な通信の維持が困難となる。

【０００７】そこで、本発明は上記のシステム内の近接する無線基地局相互間で発生する電波干渉を軽減、あるいは除去し、かつシステムの周波数有効利用を向上するための手段を提供する。

【０００８】まず、システム設置時に、各無線基地局はシステムの制御を総括する制御装置からの指示に従い、共通制御チャネルを使用して信号を送信する。但し、複数の無線基地局が同時に共通制御チャネルを送信することがないように、制御装置は送信する無線基地局を時間別に指定して実行させる。この指定に従い、近傍にある各無線基地局では送信された共通制御チャネルの信号を受信し、制御装置に自無線基地局番号と受信レベルを通知する。但し、無線基地局から送信した共通制御チャネルの送信電力が各無線基地局により異なっている場合には、送信電力レベルも共通制御チャネルの信号に含めて送信する。

【０００９】図２は移動通信システム内の無線基地局間における電波の受信レベルの例を示す図である。制御装置は、以上の動作を各無線基地局について順に行うことにより図２のような各無線基地局間の受信レベル表を作成・記憶することが可能となる。なお、この図２の詳細は後述する。この表は以下説明する様に制御装置が配下の無線基地局で使用させる同一無線チャネル内の通話チャネル、すなわちタイムスロット内のあるコードを割当てる際に、干渉妨害のない通話チャネル割当てを実施する時に使用される。

【００１０】上記で説明した手段をシステムに適用した場合の作用を説明する。

【００１１】ある無線基地局のサービスエリアに存在する移動無線機から発呼があった時、これを制御する制御装置ではその無線基地局が移動無線機と交信すべき通話チャネルを割当てることになるが、この時に交信に際し同時に進行している他の通信に対し、干渉妨害を与えず、逆に自身の交信に対して他の通信から干渉妨害を受けない様にすることが良好な通信を維持するための通信制御の最大要件である。

【００１２】すなわち、時分割多重化されたデジタル信号を用いた移動通信システムにおいて、システムの属する無線基地局のサービスエリアに存在する１つの移動無線機から発呼信号が制御チャネルを用いて送信して来たとする。これを受信した無線基地局ではこの情報を制御装置へ送信する。この信号を受信した制御装置では、この無線基地局をはじめ近傍の無線基地局で使用中の無線チャネル、無線チャネル内の各タイムスロットに含まれた通話チャネルの使用状況、及び、記憶されている図２の表とを用いて、干渉妨害の発生する可能性のない通話チャネルの存在の有無を調査する。

【００１３】その結果、干渉妨害の発生する可能性のない通話チャネルが存在する事を認識出来た場合は、その中で、システムとして最も周波数有効利用度が向上する与え方を検討し、実行することになる。

【００１４】また、上記の検討の結果、干渉妨害の発生する可能性のない通話チャネルが存在しない場合は、発呼を要請した移動無線機の重要性を考慮し、発呼を受け付けるか否か検討する。この結果、重要度の高い移動無線機の場合は、他の通信に与える干渉妨害の発生を最小限にして、システムとして最も周波数有効利用度が向上する与え方を検討し、実行することになる。

【００１５】

【課題を解決するための手段】請求項１に記載の発明は、複数の無線基地局を備えた移動通信システムであって、前記無線基地局の通信に対し、前記無線基地局間の電波干渉の情報に基づき、該電波干渉が発生しないチャネルを割り当てるチャネル割当て手段を備えたことを特徴とする。

【００１６】請求項２に記載の発明は、請求項１に記載

の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルがある場合には、該無線チャネル内の任意の通話チャネルを割り当てることを特徴とする。

【００１７】請求項３に記載の発明は、請求項１または２に記載の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルはないが、該無線チャネル内に、いずれの無線基地局も使用していない通話チャネルがある場合には、該通話チャネルの内、前記電波干渉が発生しない通話チャネルを割り当てることを特徴とする。

【００１８】請求項４に記載の発明は、請求項１ないし３のいずれかに記載の移動通信システムにおいて、システム内に複数の無線チャネルを有し、各無線チャネルは複数の通話チャネルを有し、各通話チャネルはコードまたは周波数により２以上に多重化可能であり、前記チャネル割当て手段は、いずれの無線基地局も使用していない無線チャネルがなく、該無線チャネル内に、割り当てても前記電波干渉が発生しない通話チャネルがない場合には、前記電波干渉が発生しないコードまたは周波数と通話チャネルとの組合せを割り当てることを特徴とする。

【００１９】請求項５に記載の発明は、請求項１ないし４のいずれかに記載の移動通信システムにおいて、前記チャネル割当て手段は、チャネル割当てにより、チャネルを割り当てる無線基地局以外の無線基地局によるチャネル使用に与える影響を考慮して割り当てるチャネルを決定することを特徴とする。

【００２０】請求項６に記載の発明は、請求項１ないし５のいずれかに記載の移動通信システムにおいて、前記チャネル割当て手段は、前記電波干渉が発生しないチャネルがない場合であって、チャネルを割り当てる必要がある場合には、前記無線基地局間の電波干渉の情報に基づき、発生する前記電波干渉が小さいチャネルを割り当てることを特徴とする移動通信システム。

【００２１】請求項７に記載の発明は、請求項１ないし６のいずれかに記載の移動通信システムにおいて、前記無線基地局間の電波干渉の情報は、前記無線基地局間で共通制御チャネルを用いて信号を送受信した場合の電波の受信レベルであることを特徴とする。

【００２２】請求項８に記載の発明は、複数の無線基地局を備えた移動通信システムにおけるチャネル割当て方法であって、前記無線基地局の通信に対し、前記無線基地局間の電波干渉の情報に基づき、該電波干渉が発生しないチャネルを割り当てることを特徴とする。

【００２３】以上の構成によれば、移動通信システムにおいて電波干渉を可能な限り低減でき、システムとして加入者容量の増大が図られ、かつ、利用者に良好な通信品質のサービスを提供可能となる。

【００２４】

【発明の実施の形態】以下、図１～図９を用いて本発明の実施形態を説明する。

【００２５】図１は複数の無線基地局を包含する移動通信システム（例えば、事業所用デジタルコードレス電話システム）の構成例を示す図である。この場合、４個の無線基地局７１～７４が示されており、これらがＰＢＸ等制御機能を有する制御装置７０に集線されている。各無線基地局はサービスエリア１７１～１７４を有し、そのサービスエリアが集まってシステムのサービスエリアが形成される。図中の８１～８８は移動無線機（携帯電話（データ）機、携帯端末）を示す。この移動無線機はサービスエリア１７１～１７４内を通信しながら自由に他の無線基地局のサービスエリア１７１～１７４へ移行することが出来る。

【００２６】図２は前述したように、移動通信システム内の無線基地局間における電波の受信レベルの例を示す図である。すなわち、通信に使用する各無線基地局１～５の無線チャネルに関し、各無線基地局１～５が、あらかじめ各無線基地局１～５を総括制御する制御装置に無線基地局間で干渉妨害の発生する可能性の有無、干渉量の測定結果の情報を報告したものである。ここでは送信電力は既知であるものとしているが、送信電力と受信レベルをあわせて報告するようにしてもよい。図中の各欄の数字は干渉量の大きさを示し、数値が大きいほど干渉量が大きいことを示している。また空欄は干渉量が全く測定出来なかったことを意味し、干渉関係にないことを示す。なお、例えば、無線基地局１送信、無線基地局４受信の時の干渉量測定値と無線基地局４送信、無線基地局１受信の時の測定値が異なるのは、無線基地局１と無線基地局４とにおける測定誤差が存在することを示している。同様な事は、無線基地局５送信、無線基地局１受信の時は干渉関係にあるが、逆に無線基地局１送信、無線基地局５受信の時は干渉量の測定値は得られておらず、これは無線基地局１の実効放射電力レベルが低く、無線基地局５では干渉妨害が発生していない事を示している。

【００２７】図３は時分割多重化されたデジタル信号を用いた移動通信システムで使用されているフレーム構成例のイメージを示す図である。横軸方向は時間軸を表し、１フレームのタイムスロットは１６個である。縦軸方向はコードあるいは周波数を表す。この図では縦軸方向のコードあるいは周波数の数は８であり、通話チャネル８個が多重化されている例を示している。

【００２８】図４は事業所用デジタルコードレス電話システムの無線基地局配置の例を示す図である。図中の５個の楕円は各中央部に設置されている各無線基地局１～

５のサービスエリアを示す。各無線基地局１～５は矩形で示されている。図４で楕円の重なりはサービスエリアが重なっていることを示すが、重なり合ったエリアではそのエリアを支配する各無線基地局１～５から送信される無線信号が干渉妨害を示す可能性のあることを示している。図示されていないが、システムのサービスエリア内には多数の移動無線機が存在し、通信中、或いは待機中の状態にある。また、これも図示されていないが、システムには図４のすべての無線基地局１～５を統括制御する制御装置が含まれており、各無線基地局１～５とは伝送路で結合されている。すでに説明した図２の結果は図４の様な無線基地局配置を有する場合の測定例と考えることが出来る。

【００２９】図５は図４の各無線基地局で使用されている通話チャネルの例を示す図である。すなわち、各無線基地局１～５のサービスエリアで各移動無線機との間で使用されている通話チャネルを表示したものである。

【００３０】図６はトラフィック輻輳時における図４の各無線基地局で使用されている通話チャネルの例を示す図である。

【００３１】以下、図４のシステムを例に説明する。無線基地局１のサービスエリア内に存在する移動無線機（図示せず）から制御チャネルを用いて発呼があったとする。これを受信した無線基地局１では制御装置に対し通信チャネルの割当て要求信号を送信する、この信号を受信した制御装置では、その無線基地局が移動無線機と交信すべき通話チャネル、タイムスロットを割当てる動作を開始する。この場合、制御装置ではこの時点ですでに進行している他の通信に対し、干渉妨害を与えず、逆に移動無線機自身の交信に対して他の通信から干渉妨害を受けない無線チャネル、タイムスロットの割当てが可能か否かを判断する。サービスエリア内の通話トラフィックが余り混んでいない場合には次のプロセスとなる。

【００３２】制御装置では近傍の無線基地局で使用中の無線チャネル、無線チャネル内の使用中の通話チャネル、すなわち、使用中のタイムスロットと図２の表とを用いて、干渉妨害の発生する可能性のない無線チャネル、通話チャネルの存在の有無を調査する。その結果、システム内に複数の無線チャネルを有する場合、通話トラフィックが閑散であり全く使用されていない無線チャネル２がある時は、その無線チャネル２内の任意の通話チャネル、例えば通話チャネル１を割当てることになる。

【００３３】上記の場合、無線チャネル２は無線基地局１の周辺の無線基地局２、４及び５で全く使用されていないのであるから、無線基地局１への割当ては無線チャネル２内の任意の通話チャネル、すなわち任意のタイムスロットを割当てても干渉は全く発生しない。従って、タイムスロットの割当てが容易で最も問題のない場合である。

【００３４】次にやや注意すべきタイムスロットの割当てを説明する。それは発呼して来た移動無線機近傍の通信トラフィックがやや混雑している場合である。この場合、システム内に複数の無線チャネルを有していても、全く無使用の無線チャネルはないことになる。従って制御装置では近傍にある無線基地局の交信状態のいかにかかわらず、干渉関係にない無線チャネルを与えることは出来ないので、同一無線チャネル内で複数有する通話チャネル内で干渉関係にない通話チャネル、すなわち、どのタイムスロットを与えれば干渉妨害が発生しないかの問題解決を図ることとなる。

【００３５】以下簡単のため、割当てる無線チャネル番号を１とし、無線チャネル１内で割当て可能なタイムスロット数を４とし、かつタイムスロット内の多重度を１とする。これらの使用状態が図５（ａ）の様であったとする。図で○印はそのチャネルが使用中である事、☆印はそのチャネルが不使用、すなわち、アイドルチャネルである事、従って新しい発呼があればこれを使用可能である事、△はそのチャネルは不使用であるが、もしも使用すると、隣接無線基地局で使用中の通話チャネルへ干渉妨害が発生する可能性があり、実質的に使用不可能な事を示している。図５（ａ）の各無線基地局１～５の状態を説明すると下記のように表現出来る。

【００３６】・無線基地局１では通話チャネル１が使用中、通話チャネル４はアイドル、通話チャネル２、３は使用不可能である。

【００３７】・無線基地局２では通話チャネル４はアイドル、通話チャネル１、２、３は使用不可能である。

【００３８】・無線基地局３では通話チャネル１、２が使用中、通話チャネル３、４はアイドルである。

【００３９】・無線基地局４では通話チャネル２が使用中、通話チャネル３、４はアイドル、通話チャネル１は使用不可能である。

【００４０】・無線基地局５では通話チャネル３が使用中、通話チャネル２、４はアイドル、通話チャネル１は使用不可能である。

【００４１】上記の状態にある時、無線基地局５のサービスエリア内の移動無線機から新しい発呼が起きたとする。この発呼要求を無線基地局５から受けた制御装置では無線基地局５へどの通話チャネルを与えるのがシステム全体をみて最適か、すなわち、システムとしてもっとも周波数有効利用が高いかを検討し、実行することになる。以下その方法を説明する。制御装置では無線基地局５で割当て可能な通話チャネルを調査した所、通話チャネル２、もしくは４が割当て可能な事を認識する。そこで、もしも通話チャネル２を割当てたとすると、隣接無線基地局１及び２へおよぼす影響は図５（ｂ）に示される。この図の意味は以下の通りである。

【００４２】・無線基地局５で新しく通話チャネル２（図中で□印）が使用開始されても、無線基地局１、

２、３ないし無線基地局４のすべての局における干渉妨害の発生はなく、また、新規の呼のため各無線基地局の所有する使用可能なアイドル通話チャネルが使用不可能に変化することもない。

【００４３】一方、もしも通話チャネル４を割当てたとすると、隣接無線基地局へおよぼす影響は図５（ｃ）に示されるようになる。この図の意味は以下の通りである。

【００４４】・無線基地局５で新しく通話チャネル４（図中で□印）が使用開始されても、今まで通話中のすべての局における干渉妨害の発生はないが、無線基地局１、２でアイドル通話チャネル４が使用不可能（図５（ａ）中の☆印が△印）に変化するという影響を受けることになる。この結果、無線基地局２では使用可能な通話チャネルは全くなくなり、新しい呼の発生に対応不可能となる。また、無線基地局１においても、アイドル通話チャネル４が使用不可能となるので、現在通話中の通話チャネル１がアイドルにならない限り、新しい呼の発生に対応不可能となる。

【００４５】上記は一例ではあり、無線チャネルの有するタイムスロット数を４と限定し、しかも多重度を１としたが、実際のタイムスロット数は８もしくは１６であり、また、多重度は８チャネルと多数を有しているので、上記より複雑となるが通話チャネルの付与法の基本は上記と同様である。また、実際のシステムの無線基地局数は１０局以上の例が少なくなく上記の例の様に５局と限定出来ないが、制御装置における検討事項はこの例と全く同様である。このように、制御装置における通話チャネルの割当てが、システム全体の通話トラフィックの容量増加に大きな影響を与える事、従って、周波数の有効利用率向上に果たす役割の大きい事が明らかになった。

【００４６】さらに、システム内の通話トラフィックが輻輳している状態のところへ、新しく移動無線機が発呼して来た場合（或いはシステムサービスエリアにいる移動無線機へ着呼があった場合）の制御装置のチャネル割当て方法について説明する。図６はこの様な場合のサービスエリア内の通話状況を示す。この場合、各欄の数字の意味は図５（ａ）～（ｃ）と同様である。すなわち、図６の状態はすべての無線基地局１～５において、通話トラフィックは満杯の状況であり、新しい発呼の受付を他チャネルへの干渉なしには受付不可能な状態である。この様な状態で制御装置はこれを受け付けるべきか否か。通常の加入者であれば発呼受付を拒否（ビジートーンによる拒否）となるであろう。しかしながら、発呼者が重要加入者、或いは緊急通信の場合はどうするか。この場合発呼受付拒否は不適切であり、現在通話中の他の一般加入者の強制終話による受付も考えられるがこれも上策ではなく、次善の方法として、現在通話中の他の通信に若干の干渉妨害の発生を許して、発呼受付を実施する事となる。しかしながら、この受付も実施法により、他への干渉妨害の発生を最小限に止める事が可能であり、以下説明する。

【００４７】無線基地局２のサービスエリアにいる移動無線機から新しく発呼して来た場合を想定する。制御装置は使用不可能なアイドル通話チャネル１ないし３の内どれを割当てるべきか。この検討は以下のケース１とケース２とが考えられ、それぞれ、その結果のシステム全体に及ぼす影響も異なってくる。

【００４８】・ケース１：無線基地局２で通話チャネル１を割当てると、無線基地局１への干渉量は３０ｄＢｕ、無線基地局３への干渉量は１３ｄＢｕ、無線基地局５への干渉量は８ｄＢｕ（ただし、使用不可能のため実害はなし）、無線基地局４への干渉量はなしという結果となる。

【００４９】・ケース２：無線基地局２で通話チャネル２または３を割当てると、無線基地局１への干渉量は３０ｄＢｕ（ただし、使用不可能のため実害はなし）、無線基地局３への干渉量は１３ｄＢｕ、無線基地局５への干渉量は８ｄＢｕ、無線基地局４への干渉量はなしという結果となる。

【００５０】従って、この場合はケース１では無線基地局１で実際に行われている通信に３０ｄＢｕと言う大きな干渉妨害を与えるが、ケース２では無線基地局５で行われている通信に８ｄＢｕというかなり小さな干渉妨害を与えることになる。ただし、ケース１、ケース２とも無線基地局３への干渉量は１３ｄＢｕという少し大きな干渉妨害を与えることになるがこれは止むを得ない。従って、無線基地局２では通話チャネル２または３を割当てるのが最適となる。

【００５１】上記は一例であり、しかも無線チャネルの有するタイムスロット数を４と限定し、かつ多重度を１としたが、実際のタイムスロット数は８もしくは１６であり、また、多重度は８チャネルと多数を有しているので、上記より複雑となるが通話チャネルの付与法の基本は上記と同様である。さらに、実際のシステムの無線基地局数は１０局以上の例が少なくなく上記の例の様に５局と限定出来ないが、制御装置における検討事項はこの例と全く同様である。このように、制御装置における通話チャネルの割当てが、システム全体の通話トラフィックの容量増加に大きな影響を与える事、従って、周波数の有効利用率向上に果たす役割の大きい事が明らかになった。

【００５２】以下、図７に示すシステム動作のフローチャートにより図１の作成法を、図８及び図９に示すシステム動作のフローチャートにより、上記に説明したシステム内の通話トラフィック状態に適した制御装置の通話チャネル割当て方法を説明する。

【００５３】図７は移動通信システム内の無線基地局間における電波の受信レベルを得るためのフローチャート

である。

【００５４】以下、図７に示す手順を図４に示すシステムに適用した場合を例として説明する。図４のシステムの制御装置、無線基地局１、２、３、４、及び５は動作を開始しているがまだ実際のシステム運用は行われていないとする。制御装置では配下の無線基地局１ないし５のすべてに対し、割当てられた時間タイミングにより共通制御チャネルを用いて信号の送信を規定の送信電力レベルで行うこと、及び、周辺の無線基地局より送信された信号の受信レベルを測定すること、等を要請する信号を送付する（Ｓ１０）。制御装置からの信号を受信した各無線基地局１ないし５では夫々に与えられた時間タイミングにより共通制御チャネルで信号を送信すると共に、周辺の無線基地局より送信された信号の受信レベルの計測を実行する（Ｓ２０）。なお、各無線基地局から送信される信号には制御装置の要請で自無線基地局のＩＤ（識別情報）のほか共通制御チャネルの送信電力レベルも含まれている。

【００５５】次に制御装置では配下の無線基地局１ないし５のすべてに対し、割当てられた時間タイミングにより上記の測定結果を受信レベルで制御装置へ送信するように要請する（Ｓ３０）。この指示を受けた各無線基地局１ないし５では夫々に与えられた時間タイミングにより各受信レベルを制御装置へ送信する（Ｓ４０）。無線基地局１ないし５からのこれらの各受信レベルを受信した制御装置では、各無線基地局相互間の受信レベルを作成し記憶する（Ｓ５０）。

【００５６】以上のようなプロセスにより図２は完成され、以下制御装置１０ではこの図２を活用した発呼、着呼等のシステム動作が開始可能となる。

【００５７】次に、システム内の通話トラフィック状態がやや多く、制御装置の通話チャネル割当てに注意が必要な場合のシステム動作を説明する。

【００５８】図８は、システム内の通話トラフィック状態がやや多く、制御装置の通話チャネル割当てに注意が必要な場合のシステム動作を示すフローチャートである。システムの制御装置、無線基地局１、２、３、４、及び５をはじめサービスエリア内にある多くの移動無線機はすでにシステム動作を開始しているものとする。システム内の通話トラフィックは図５（ａ）に示されている状態にあるとする。この時に移動無線機から新しい発呼が起こされ、上り制御チャネルで発呼信号が送出されたとする（Ｓ２１０）。この信号は最寄りの無線基地局５で受信され、制御装置へ通話チャネル割当ての要請信号を送信する（Ｓ２２０）。無線基地局５よりの通話チャネル割当て要請を受けた制御装置ではシステムのサービスエリア内の通話トラフィックを判断した所、図５（ａ）で示されている状態にあることを認識し、図２を参考に無線基地局５で使用させる通話チャネルの検討を開始する（Ｓ２３０）。この結果、近傍の無線基地局で使用している通話チャネルへの干渉妨害を与えることなく、通話チャネル２もしくは４が可能であることが判明する。ただし、通話チャネル２を与えた場合は、すでに説明した図５（ｂ）のように、近傍の無線基地局１、２の所有するアイドルチャネルの状態に変化はないが、通話チャネル４を与えた場合は、図５（ｃ）のように、近傍の無線基地局１、２の所有するアイドルチャネルの状態が使用可能から使用不可能に変化することがわかる。従って、通話チャネル４を与えることは賢明でなく通話チャネル２を与えるべきと判断する。

【００５９】そして、無線基地局５に対し、通話チャネル２を与えることを連絡する（Ｓ２４０）。この連絡を受信した無線基地局５では移動無線機へ通話チャネル２を使用するように指示する（Ｓ２５０）。移動無線機ではこの指示信号に従い通話チャネル２でダイヤル信号を送信する（Ｓ２６０）。この信号は無線基地局５で受信され、制御装置へ転送される（Ｓ２７０）。制御装置は通信網側へ転送し（Ｓ２８０）、通信網内の被呼電話機へ伝える。ただし、通信網や被呼電話機は図示されていない。以上のプロセスで発呼者と被呼者の間での伝送路の設定が完了し、被呼者が電話機をハングアップすると通話が開始される（Ｓ２９０）。

【００６０】さらに、システム内の通話トラフィックが図６に示されているような輻輳状態にある時の通話チャネル割当てに関し説明する。

【００６１】図９は、システム内の通話トラフィックが輻輳状態にある時の通話チャネル割当てのシステム動作を示すフローチャートである。サービスエリア内にある多くの移動無線機はそれぞれ対向して各無線基地局と交信中であり、その結果、制御装置ではサービスエリア内で新しい呼が発生した場合は他の通話に干渉妨害を与えることなく通話チャネルを付与することは不可能なことを認識している。このような通話トラフィック状態にある時、無線基地局２のサービスエリア内にある移動無線機から新規に発呼要求が出されたとする。新規に発呼要求が重要加入者からの場合はどうするか。このような場合の動作を図９に示すシステム動作のフローチャートにより説明する。システムの制御装置、無線基地局１、２、３、４、及び５をはじめサービスエリア内にある多くの移動無線機はすでにシステム動作を開始している。

【００６２】この時に移動無線機から新しい発呼が起こされ、上り制御チャネルで発呼信号が送出されたとする（Ｓ４１０）。この信号は最寄りの無線基地局２で受信され、制御装置へ通話チャネル割当ての要請信号を送信する（Ｓ４２０）。無線基地局２よりの通話チャネル割当て要請を受けた制御装置ではシステムのサービスエリア内の通話トラフィックを調査した所、図６で示されている状態にあることを認識するが、発呼者が重要加入者であるので、図２を参考に若干の干渉妨害を許して、無線基地局２で使用させる通話チャネルの検討を開始す

る。

【００６３】この結果、無線基地局２ではアイドルチャネルではあるが、使用不可能な通話チャネル１、２或いは３が存在することを認識する。この内、どのチャネルを与えれば近傍の無線基地局の交信に与える干渉妨害が最も少ないかを検討することになる（Ｓ４３０）。そこで、通話チャネル１を与えた場合を調査すると、隣接の無線基地局１へ３０ｄＢｕ、無線基地局３へ１３ｄＢｕ、及び無線基地局５へ８ｄＢｕの干渉妨害を与えることがわかる。ただし、無線基地局５に対して、通話チャネル１は使用不可能チャネルであるから実害はない。ついで、通話チャネル２または３を与えた場合を調査すると、この場合は無線基地局１へは使用不可能チャネルであるから実害はない。しかし、無線基地局３へ１３ｄＢｕ、及び無線基地局５へ８ｄＢｕの干渉妨害を与えることがわかる。以上の結果を比較検討して、無線基地局１へ３０ｄＢｕもの大きな干渉妨害を与える通話チャネル１の使用は適当でなく、８ｄＢｕと干渉妨害量の少ない無線基地局５へと、無線基地局３へ１３ｄＢｕの干渉妨害量を与える通話チャネル２または３の使用がシステム総合の干渉妨害量が少ないとの結論を得る。従って、通話チャネル２を与えるべきと判断する。

【００６４】そして、無線基地局２に対し、通話チャネル２を与えることを連絡する（Ｓ４４０）。この連絡を受信した無線基地局２では移動無線機へ通話チャネル２を使用するように指示する（Ｓ４５０）。移動無線機ではこの指示信号に従い通話チャネル２でダイヤル信号を送信する（Ｓ４６０）。この信号は無線基地局２で受信され、制御装置へ転送される（Ｓ４７０）。制御装置は通信網側へ転送し（Ｓ４８０）、通信網内の被呼電話機へ伝える。ただし、通信網や被呼電話機は図示されていない。以上のプロセスで発呼者と被呼者の間での伝送路の設定が完了し、被呼者が電話機をハングアップすると通話が開始される（Ｓ４９０）。

【００６５】以上説明したように、システム内の通話トラフィックが輻輳状態にある時でも重要加入者へは発呼の受付を行い、自及び他の通信相互間で若干の干渉妨害の発生は是認しつつ、なお、その干渉妨害の発生量を可及的に最小化を図ることがシステム運用の信頼性を高め、かつ周波数の有効利用につながることになる。

【００６６】本実施形態においては、通話チャネル（タイムスロット）内のコードまたは周波数による多重度が１である場合を例として説明したが、多重度が２以上であれば、いずれの無線基地局も使用していない無線チャネルがなく、該無線チャネル内に、割り当てても電波干渉が発生しない通話チャネルがない場合でも、コードまたは周波数を変えて、当該コードまたは周波数と通話チャネルの組み合わせを割り当てることにより電波干渉を回避し得る。

【００６７】

【発明の効果】今後ますます増大する無線利用のニーズに対応するためには、さらなる周波数の有効利用が求められる一方、低コストのシステムが要求される。その結果、デジタルコードレス電話システムの様に無線基地局配置の設置が電波伝搬特性上の考慮をあまりなされないで行われる傾向がある。このような無線基地局配置がなされたシステムでは、サービスエリア内の通信のトラフィックが増大すると同一システム内の無線基地局と移動無線機との間で行われている通信が、近傍にある無線基地局と移動無線機との間で行われている通信との間で、相互に干渉妨害が発生する可能性がある。その結果、通信品質の劣化や、周波数の有効利用度が低下する。これに対し、本発明を適用すれば同一システム内の近接する無線基地局相互間で発生する電波干渉を未然に防止可能となり、或いはシステム内の通話トラフィックが輻輳している時においても、本発明を適用することにより、新しい発呼に対する通話チャネルの付与を可及的に干渉妨害の少ない状態で実現することが可能となる。その結果、通信品質の向上と、システム内同時通話者数の増大によるシステムの周波数有効利用の向上が可能となり、本発明の効果は極めて大きい。

【図面の簡単な説明】

【図１】複数の無線基地局を包含する移動通信システムの構成例を示す図である。

【図２】移動通信システム内の無線基地局間における電波の受信レベルの例を示す図である。

【図３】時分割多重化されたデジタル信号を用いた移動通信システムで使用されているフレーム構成例のイメージを示す図である。

【図４】事業所用デジタルコードレス電話システムの無線基地局配置の例を示す図である。

【図５】図４の各無線基地局で使用されている通話チャネルの例を示す図である。

【図６】トラフィック輻輳時における図４の各無線基地局で使用されている通話チャネルの例を示す図である。

【図７】移動通信システム内の無線基地局間における電波の受信レベルを得るためのフローチャートである。

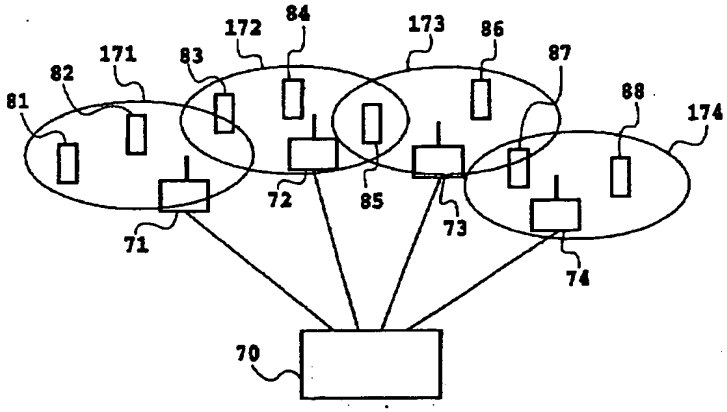
【図８】システム内の通話トラフィック状態がやや多く、制御装置の通話チャネル割当てに注意が必要な場合のシステム動作を示すフローチャートである。

【図９】システム内の通話トラフィックが輻輳状態にある時の通話チャネル割当てのシステム動作を示すフローチャートである。

【符号の説明】

１～５、７１～７４　無線基地局
７０　制御装置
８１～８８　移動無線機
１０１～１０５　無線基地局のサービスエリア

【図１】



【図２】

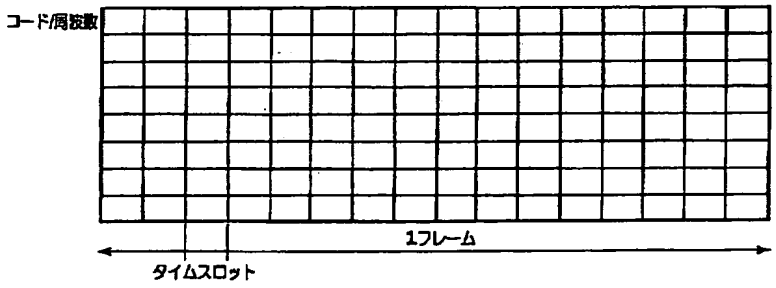
		送信BS				
		BS1	BS2	BS3	BS4	BS5
受信BS	BS1		30dBu	-	12dBu	8dBu
	BS2	28dBu		10dBu	-	5dBu
	BS3	-	13dBu		-	-
	BS4	15dBu	-	-		-
	BS5	-	8dBu	-	-	

制御装置で作成される受信レベル表の一例

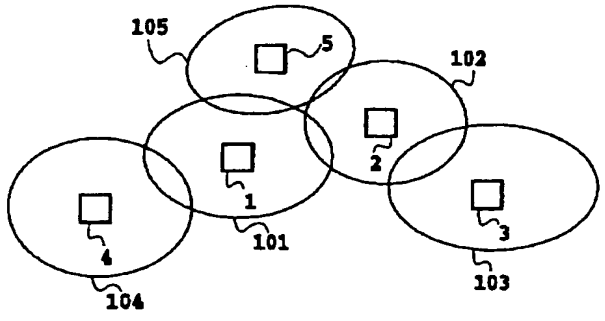
【図６】

CH番号 / 無線基地局番号	1	2	3	4
1	○	△	△	△
2	△	△	△	○
3	○	○	○	△
4	△	○	○	○
5	△	○	○	△

【図３】



【図４】



【図５】

(a)

無線基地局番号＼CH番号	1	2	3	4
1	○	△	△	☆
2	△	△	△	☆
3	○	○	☆	☆
4	△	○	☆	☆
5	△	☆	○	☆

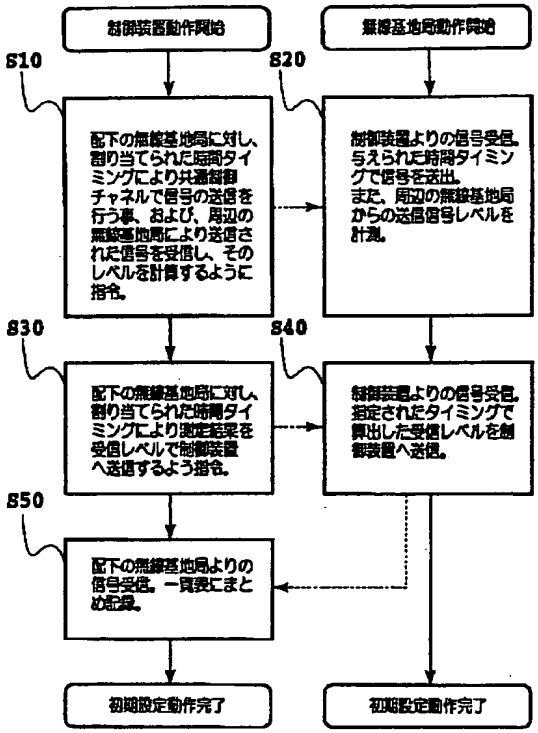
(b)

無線基地局番号＼CH番号	1	2	3	4
1	○	△	△	☆
2	△	△	△	☆
3	○	○	☆	☆
4	△	○	☆	☆
5	△	□	○	☆

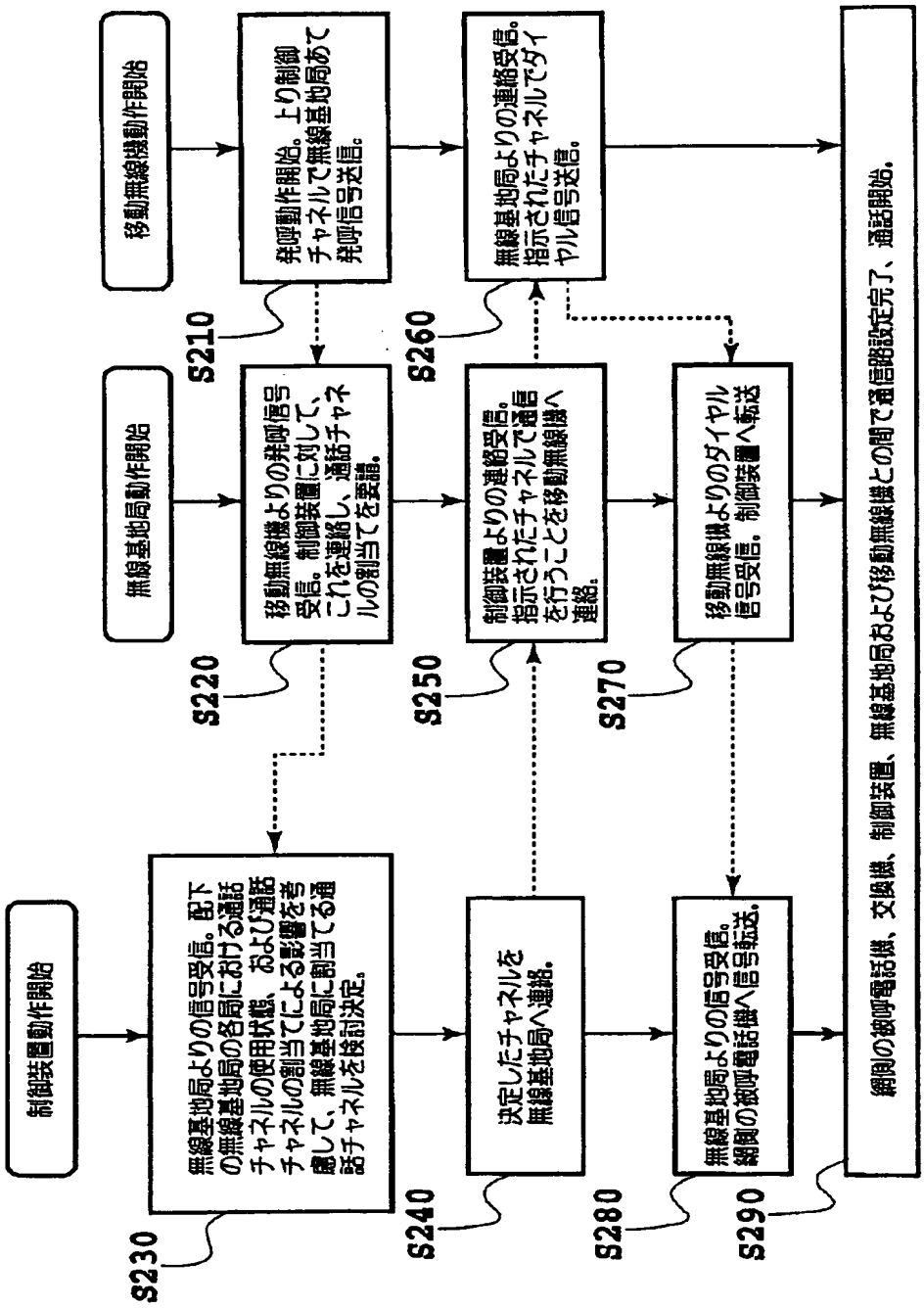
(c)

無線基地局番号＼CH番号	1	2	3	4
1	○	△	△	△
2	△	△	△	△
3	○	○	☆	☆
4	△	○	☆	☆
5	△	☆	○	□

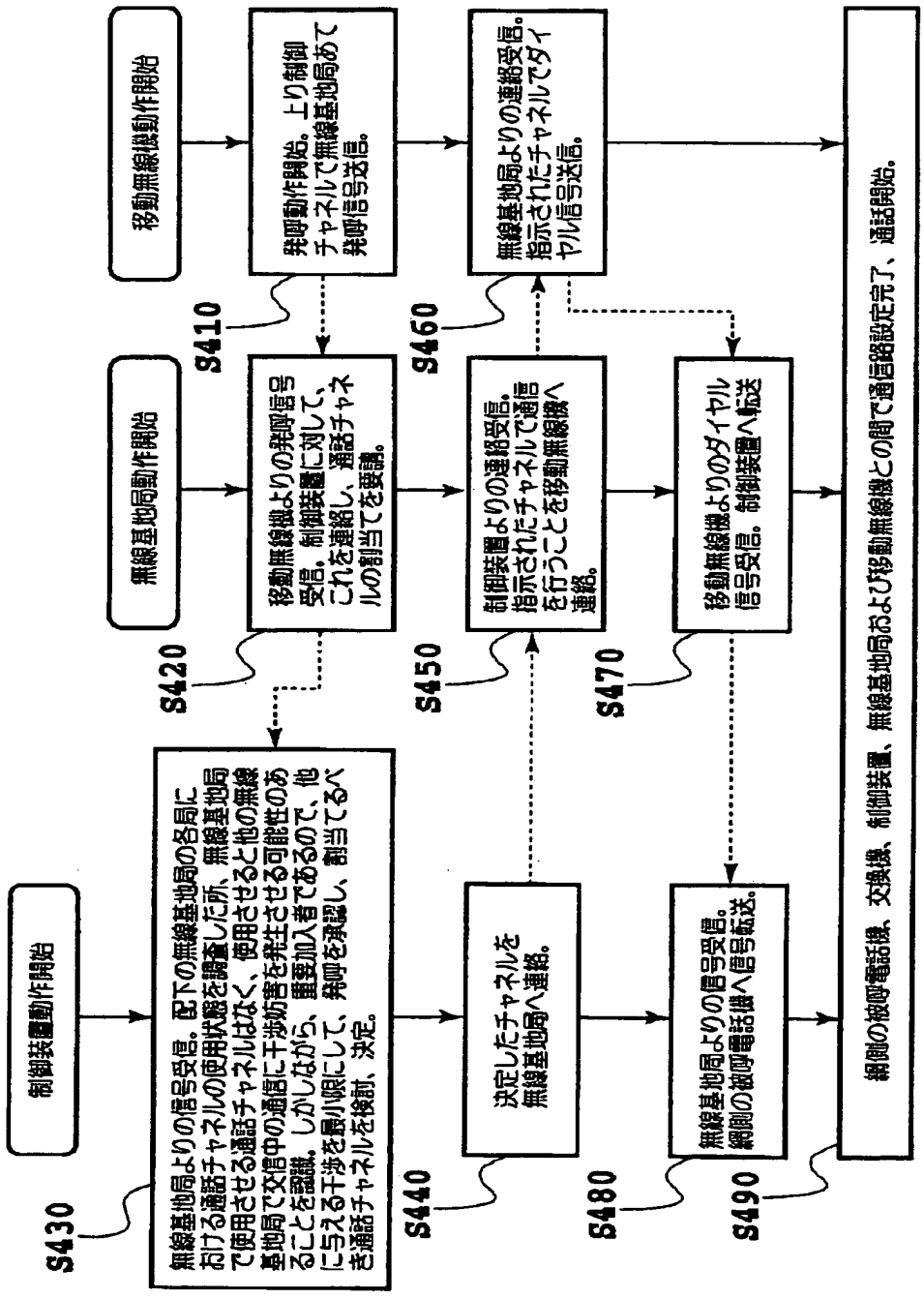
【図７】



【図８】


制御装置動作開始
無線基地局動作開始
移動無線機動作開始
無線基地局よりの信号受信。配下の無線基地局の各局における通話チャネルの使用状態、および通話チャネルの割当てによる影響を考慮して、無線基地局に割当てる通話チャネルを検討決定。
S230
移動無線機よりの発呼信号受信。制御装置に対して、これを連絡し、通話チャネルの割当てを要請。
S220
発呼動作開始。上り制御チャネルで無線基地局あて発呼信号送信。
S210
決定したチャネルを無線基地局へ連絡。
S240
制御装置よりの連絡受信。指示されたチャネルで通信を行うことを移動無線機へ連絡。
S250
無線基地局よりの連絡受信。指示されたチャネルでダイヤル信号送信。
S260
移動無線機よりのダイヤル信号受信。制御装置へ転送
S270
無線基地局よりの信号受信。網側の被呼電話機へ信号転送。
S280
網側の被呼電話機、交換機、制御装置、無線基地局および移動無線機との間で通信路設定完了、通話開始。
S290

【図９】


制御装置動作開始
無線基地局動作開始
移動無線機動作開始
S430
無線基地局よりの信号受信。配下の無線基地局の各局における通話チャネルの使用状態を調査した所、無線基地局で使用させる通話チャネルは少なく、使用させると他の無線基地局で交信中の通信に干渉妨害を発生させる可能性のあることを認識。しかしながら、重要加入者であるので、他に与える干渉を最小限にして、発呼を承認し、割当てるべき通話チャネルを検討、決定。
S440
決定したチャネルを無線基地局へ連絡。
S450
制御装置よりの連絡受信。指示されたチャネルで通信を行うことを移動無線機へ連絡。
S460
無線基地局よりの連絡受信。指示されたチャネルでダイヤル信号送信。
S470
移動無線機よりのダイヤル信号受信。制御装置へ転送
S480
無線基地局よりの信号受信。網側の被呼電話機へ信号転送。
S490
網側の被呼電話機、交換機、制御装置、無線基地局および移動無線機との間で通信路設定完了、通話開始。
S410
発呼動作開始。上り制御チャネルで無線基地局あて発呼信号送信。
S420
移動無線機よりの発呼信号受信。制御装置に対して、これを連絡し、通話チャネルの割当てを要請。

フロントページの続き

Ｆターム(参考) 5K022 EE02 EE11 EE21 EE31 FF01
5K028 AA02 BB06 CC02 CC05 DD01
DD02 HH02 LL02 LL42 PP04
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DA19 DB17 EA02
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DD42 DD44 DD57 EE10 EE16
GG01 GG11 HH21 JJ11 JJ12
JJ17 LL11

JAPANESE [JP,2000-316183,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Migration communication system characterized by having the channel assignment means which is the migration communication system equipped with two or more base transceiver stations, and assigns the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.
[Claim 2] It is the migration communication system which it has two or more radio channels in a system in migration communication system according to claim 1, and each radio channel has two or more message channels, and is characterized by said channel assignment means assigning the message channel of the arbitration in this radio channel when there is a radio channel which is using neither of the base transceiver stations.
[Claim 3] The radio channel to which it has two or more radio channels, each radio channel has two or more message channels, and neither of the base transceiver stations is being used for said channel assignment means in a system in migration communication system according to claim 1 or 2 is migration communication system characterized by assigning the message channel which said electric-wave interference does not generate among these message channels when there is a message channel which is using neither of the base transceiver stations in this radio channel, although there is nothing.
[Claim 4] In migration communication system according to claim 1 to 3, it has two or more radio channels in a system. Each radio channel has two or more message channels, and each message channel can be multiplexed or more to two with a code or a frequency. Said channel assignment means Even if it assigns in this radio channel, when there is no radio channel which is using neither of the base transceiver stations, and there is no message channel which said electric-wave interference does not generate Migration communication system characterized by assigning the combination of the code or frequency which said electric-wave interference does not generate, and a message channel.
[Claim 5] It is the migration communication system characterized by determining the channel assigned in consideration of the effect which it has on the channel use by base transceiver stations other than the base transceiver station where said channel assignment means assigns a channel by channel assignment in migration communication system according to claim 1 to 4.
[Claim 6] It is the migration communication system which is the case where there is no channel in which said electric-wave interference does not generate said channel assignment means in migration communication system according to claim 1 to 5, and is characterized by said electric-wave interference to generate assigning a small channel based on the information on the electric-wave interference between said base transceiver stations when a channel needs to be assigned.
[Claim 7] It is the migration communication system characterized by being the receiving level of an electric wave when the information on the electric-wave interference between said base transceiver stations transmits in migration communication system according to claim 1 to 6 and receives a signal using a common control channel between said base transceiver stations.
[Claim 8] The channel assignment approach in the migration communication system which is the

channel assignment approach in the migration communication system equipped with two or more base transceiver stations, and is characterized by assigning the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention — for example, — time-division multiplexing — carrying out — having had — a digital signal — using — migration — communication system — a base transceiver station — setting — a communication link — using it — a message channel — interference — active jamming — completely — not generating — or — or the approach and system which carry out message channel allocation with few yields — being related . Many base transceiver stations of a large number belonging to the same system exist in a service area in detail. the mobile radio machine (the terminal for migration — the outside of a mobile radio machine — a portable telephone —) with which two or more near base transceiver stations exist in each service area When performing radio good although there are another names, such as a mobile data terminal, while naming generically with a mobile radio machine below, Based on the information which carried out the collection storage of each base transceiver station in advance with the control device which carries out general management, if the same radio channel and the same time slot are assigned to the same time amount to two or more base transceiver stations, interference active jamming may be generated. While mitigating thru/or removing such interference active jamming to the maximum extent, it is related with the message channel allocation approach and system which aimed at the frequency deployment of a system.
[0002]
[Description of the Prior Art] As for mobile communication system, expansion of a service area and the rapid expansion of a user (subscriber) continue as an information communication link. A deployment of a frequency is indispensable in order to cope with the rapid increment in a subscriber. The technical solution has digitization of a signal format, and the service area of one base transceiver station is narrowed, and there is the approach of raising the rate of reuse of a frequency in a different place regarding the place. As a system which the service area of one base transceiver station made extremely narrow with the radius of about 100 meters, there is a digital cordless telephone system which uses for example, a 1.9GHz band in our country. Although it is required that the channel capacity of this whole system should be quite large, as a result of narrow-izing the service area which one base transceiver station governs, the necessary channel capacity per one base transceiver station will be mitigated considerably. However, the number of necessary base transceiver stations of having become a large number considerably contained in a system is natural.
[0003] If it explains concretely, a digital cordless telephone system will be taken for an example, for example. The base transceiver station of this system may generate interference active jamming, if a base transceiver station installation location assigns the same radio channel and the same time slot to the same time amount to two or more base transceiver stations which do not have a mutual intervention in advance and which a ** office design is not strictly carried out like, therefore distance spacing between base transceiver stations is different, consequently adjoin unlike other cellular system.
[0004] However, since there were many radio channels currently assigned to the system, electric-wave interference could be avoided with the simple technique, and a problem did not

actualize. It owns the 37 radio-channel x4(slot) =148 communication channel (8 message-channel TDMA-TDD (Time Division MultipleAccess Time Division Duplex)), and, on the other hand, a communication link frequency is because 4 or 8 message-channel extent is enough as the channel capacity per one base transceiver station, i.e., the communications traffic used for coincidence. For this reason, especially in each base transceiver station, even if it does not restrict the message channel to assign and which can be communicated, interference power is supervised at any time, and correspondence of good communication link maintenance is attained by assigning a message channel with low interference level to a communication link message channel.

[0005] However, in TDMA/CDMA (Time Division Multiple Access/ Code Division MultipleAccess) which is one sort of the digital signal format adopted from a viewpoint which aims at much more frequency deployment, the problem on the following techniques will occur and it will be pressed for solution.

[0006]

[Problem(s) to be Solved by the Invention] In the system using the digital signal (TDMA/CDMA) by which time-division multiplexing was carried out, by assigning a message channel to each base station per time slot, message channel quota control can be simplified and it leads to capacity increase from a viewpoint of an interference canceller technique. However, since the distance between base transceiver stations in a system is not necessarily uniform, decision of the base station which can be interfering within the same system, and the base station which does not become interference cannot be performed. Therefore, in having assigned indiscriminately as mentioned above, possibility that interference active jamming will occur becomes large, and maintenance of a good communication link becomes difficult.

[0007] Then, this invention offers the means for mitigating or removing electric-wave interference generated between [which is approached in the above-mentioned system] base transceiver stations, and improving a frequency deployment of a system.

[0008] First, each base transceiver station transmits a signal using a common control channel according to the directions from the control device which summarizes control of a system at the time of a system installation. However, a control unit specifies the base transceiver station to transmit according to time amount, and is performed so that two or more base transceiver stations may not transmit a common control channel to coincidence. According to this assignment, the signal of the transmitted common control channel is received and a self-base transceiver station number and receiving level are notified to a control device in each near base transceiver station. However, when the transmitted power of the common control channel transmitted from the base transceiver station changes with each base transceiver stations, transmitted power level is also included and transmitted to the signal of a common control channel.

[0009] Drawing 2 is drawing showing the example of the receiving level of the electric wave between the base transceiver stations in migration communication system. A control unit becomes possible [creating and memorizing the receiving level table between each base transceiver station like drawing 2] by performing the above actuation in order about each base transceiver station. In addition, the detail of this drawing 2 is mentioned later. In case a control device assigns the message channel in the same radio channel made to use it in a subordinate's base transceiver station, i.e., a certain code in a time slot, so that it may explain below, this table is used when carrying out message channel allocation without interference active jamming.

[0010] The operation at the time of applying the means explained above to a system is explained.

[0011] Although the base transceiver station will assign the message channel which should communicate with a mobile radio machine in the control device which controls this when call origination occurs from the mobile radio machine which exists in the service area of a certain base transceiver station They are the maximum requirements for communications control for not doing interference active jamming but making it not receive interference active jamming from other communication links to own communication to other communication links which are advancing to coincidence on the occasion of communication at this time conversely to maintain

a good communication link.
[0012] That is, suppose that the call origination signal has transmitted using a control channel from one mobile radio machine which exists in the service area of the base transceiver station where a system belongs in the migration communication system using the digital signal by which time-division multiplexing was carried out. In the base transceiver station which received this, this information is transmitted to a control unit. In the control device which received this signal, the existence of the existence of the message channel which cannot generate interference active jamming is investigated using the operating condition of the message channel contained in each time slot in a radio channel in use and a radio channel in the nearby base transceiver station including this base transceiver station, and the table of drawing 2 memorized.
[0013] Consequently, when it has been recognized that the message channel which cannot generate interference active jamming exists, in it, the way of giving whenever [whose / frequency deployment] improves most as a system will be examined, and it will perform.
[0014] Moreover, when the message channel which cannot generate interference active jamming does not exist as a result of the above-mentioned examination, in consideration of the importance of the mobile radio machine which demanded call origination, it examines whether call origination is received. Consequently, generating of the interference active jamming done to other communication links is made into the minimum, in the case of a mobile radio machine with a high significance, the way of giving whenever [whose / frequency deployment] improves most as a system will be examined, and it will perform it.
[0015]
[Means for Solving the Problem] Invention according to claim 1 is the migration communication system equipped with two or more base transceiver stations, and is characterized by having the channel assignment means which assigns the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.
[0016] In migration communication system according to claim 1, as for invention according to claim 2, each radio channel has two or more message channels by having two or more radio channels in a system, and said channel assignment means is characterized by assigning the message channel of the arbitration in this radio channel, when there is a radio channel which is using neither of the base transceiver stations.
[0017] As for invention according to claim 3, each radio channel has two or more message channels by having two or more radio channels in a system in migration communication system according to claim 1 or 2, and although there is no radio channel for which said channel assignment means is using neither of the base transceiver stations, when there is a message channel which is using neither of the base transceiver stations in this radio channel, it is characterized by assigning the message channel which said electric-wave interference does not generate among these message channels.
[0018] Invention according to claim 4 is set to migration communication system according to claim 1 to 3. In a system, have two or more radio channels and each radio channel has two or more message channels. Each message channel can be multiplexed or more to two with a code or a frequency. Said channel assignment means Even if it assigns in this radio channel, when there is no radio channel which is using neither of the base transceiver stations, and there is no message channel which said electric-wave interference does not generate, it is characterized by assigning the combination of the code or frequency which said electric-wave interference does not generate, and a message channel.
[0019] It is characterized by invention according to claim 5 determining the channel which assigns said channel assignment means by channel assignment in migration communication system according to claim 1 to 4 in consideration of the effect which gives the channel use by base transceiver stations other than the base transceiver station which assigns a channel.
[0020] Invention according to claim 6 is migration communication system which is the case where there is no channel in which said electric-wave interference does not generate said channel assignment means in migration communication system according to claim 1 to 5, and is characterized by said electric-wave interference to generate assigning a small channel based on

the information on the electric-wave interference between said base transceiver stations when a channel needs to be assigned.
[0021] Invention according to claim 7 is characterized by the information on the electric-wave interference between said base transceiver stations being the receiving level of the electric wave at the time of transmitting and receiving a signal using a common control channel between said base transceiver stations in migration communication system according to claim 1 to 6.
[0022] Invention according to claim 8 is the channel assignment approach in the migration communication system equipped with two or more base transceiver stations, and is characterized by assigning the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.
[0023] According to the above configuration, in migration communication system, electric-wave interference can be reduced as much as possible, increase of subscriber capacity is achieved as a system, and offer of service of good communication link quality is attained at a user.
[0024]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained using drawing 1 - drawing 9 .
[0025] Drawing 1 is drawing showing the example of a configuration of the migration communication system (for example, digital cordless telephone system for places of business) which includes two or more base transceiver stations. In this case, four base transceiver stations 71-74 are shown, and lines are concentrated by the control unit 70 with which these have control functions, such as PBX. Each base transceiver station has service areas 171-174, the service area gathers, and the service area of a system is formed. 81-88 in drawing show a mobile radio machine (a cellular-phone (data) machine, personal digital assistant). This mobile radio machine can shift to the service areas 171-174 of other base transceiver stations freely, communicating the inside of a service area 171-174.
[0026] Drawing 2 is drawing showing the example of the receiving level of the electric wave between the base transceiver stations in migration communication system, as mentioned above. That is, the information on the existence of possibility that interference active jamming of the control unit with which each base transceiver stations 1-5 carry out multiple unit control of each base transceiver stations 1-5 beforehand between base transceiver stations will occur about the radio channel of each base transceiver stations 1-5 used for a communication link, and the measurement result of the amount of interference is reported. Although transmitted power shall be known, you may make it report in accordance with transmitted power and receiving level here. The figure of each column in drawing shows the magnitude of the amount of interference, and it is shown that the amount of interference is so large that a numeric value is large. Moreover, it is shown that a blank means that the amount of interference was not able to measure at all, and there is in interference relation. [no] In addition, for example, that the amount measured value of interference at the time of base transceiver station 1 transmission and base transceiver station 4 reception differs from the measured value at the time of base transceiver station 4 transmission and base transceiver station 1 reception shows that the measurement error in a base transceiver station 1 and a base transceiver station 4 exists. Although the same thing has an interference relation at the time of base transceiver station 5 transmission and base transceiver station 1 reception, conversely, the measured value of the amount of interference is not obtained at the time of base transceiver station 1 transmission and base transceiver station 5 reception, but this has the low effective-radiated-power level of a base transceiver station 1, and the base transceiver station 5 shows that interference active jamming has not occurred.
[0027] Drawing 3 is drawing showing the image of the example of a frame structure currently used with the migration communication system using the digital signal by which time-division multiplexing was carried out. The direction of an axis of abscissa expresses a time-axis, and the number of the time slots of one frame is 16. The direction of an axis of ordinate expresses a code or a frequency. In this drawing, the code of the direction of an axis of ordinate or the number of frequencies is 8, and shows the example by which eight message channels are multiplexed.

[0028] Drawing 4 is drawing showing the example of base transceiver station arrangement of the digital cordless telephone system for places of business. The ellipse of five pieces in drawing shows the service area of each base transceiver stations 1-5 currently installed in each center section. Each base transceiver stations 1-5 are shown by the rectangle. Although the lap of an ellipse shows that the service area has lapped by drawing 4 , the overlapping area shows that the radio signal transmitted from each base transceiver stations 1-5 which govern the area may show interference active jamming. Although not illustrated, many mobile radio machines exist in the service area of a system, and it is under a communication link or in an waiting condition. Moreover, although this is not illustrated, either, the control unit which carries out generalization control of all the base transceiver stations 1-5 of drawing 4 is contained in the system, and it is combined in each base transceiver stations 1-5 in the transmission line. The result of already explained drawing 2 can be considered to be an example of measurement in the case of having base transceiver station arrangement like drawing 4 .
[0029] Drawing 5 is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 . That is, the message channel currently used between each mobile radio machine is displayed in the service area of each base transceiver stations 1-5.

[0030] Drawing 6 is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 at the time of traffic congestion.
[0031] Hereafter, the system of drawing 4 is explained to an example. Suppose that call origination occurred using the control channel from the mobile radio machine (not shown) which exists in the service area of a base transceiver station 1. In the base transceiver station 1 which received this, that base transceiver station starts the message channel which should communicate with a mobile radio machine, and the actuation which assigns a time slot with the control device which transmits the allocation demand signal of a communication channel to a control device and which received this signal. In this case, in a control unit, to other communication links which it is at this time and have already advanced, interference active jamming is not done but it judges whether allocation of the radio channel and time slot which do not receive interference active jamming from other communication links to the own communication of a mobile radio machine conversely is possible. It becomes the following process when the message traffic in a service area is seldom crowded.
[0032] In a control device, the existence of the existence of the radio channel which cannot generate interference active jamming in a nearby base transceiver station using a radio channel in use and a message channel in use [in a radio channel], i.e., a time slot in use and the table of drawing 2 , and a message channel is investigated. Consequently, when it has two or more radio channels in a system and there is a radio channel 2 for which message traffic is leisurely and is not used at all, the message channel 1 of the arbitration in the radio channel 2, for example, a message channel, will be assigned.
[0033] Since the radio channel 2 is not used at all in the surrounding base transceiver stations 2, 4, and 5 of a base transceiver station 1 in the above-mentioned case, even if the allocation to a base transceiver station 1 assigns the message channel of the arbitration in a radio channel 2, i.e., the time slot of arbitration, interference is not generated at all. Therefore, allocation of a time slot is easy and it is the case of being the most satisfactory.
[0034] Next, allocation of the time slot which should be a little careful of is explained. It is the case where the communications traffic near [which has carried out call origination] the mobile radio machine is a little crowded. In this case, even if it has two or more radio channels in the system, there will be no non-used radio channel. Therefore, the communication condition of the base transceiver station located in a control unit in near is not concerned how, but since the radio channel which is not in interference relation cannot be given, if the message channel which is not in interference relation within the message channel which it has within the same radio channel, i.e., which time slot, is given, that problem solving which interference active jamming does not generate will be planned.
[0035] Below, since it is easy, the wireless channel number to assign is set to 1, and the number of time slots which can be assigned within a radio channel 1 is set to 4, and the multiplicity in a

time slot is set to 1. Suppose that these busy conditions were the appearance of drawing 5 (a). Although the channel is that they are usable in this if the channel's using O mark by a diagram and * mark have that the channel is un-using it, i.e., an idle channel, therefore new call origination and ** did not use it, if it is used, interference active jamming may occur to a message channel in use in an adjoining base transceiver station, and the substantially unusable thing is shown. If the condition of each base transceiver stations 1-5 of drawing 5 (a) is explained, it can express as follows.

[0036] - While a message channel 1 uses it, a message channel 4 is an idle and message channels 2 and 3 are unusable in a base transceiver station 1.

[0037] - A message channel 4 is an idle and message channels 1, 2, and 3 are unusable in a base transceiver station 2.

[0038] - In a base transceiver station 3, while message channels 1 and 2 use it, message channels 3 and 4 are idles.

[0039] - While a message channel 2 uses it, message channels 3 and 4 are idles and the message channel 1 is unusable in a base transceiver station 4.

[0040] - While a message channel 3 uses it, message channels 2 and 4 are idles and the message channel 1 is unusable in a base transceiver station 5.

[0041] When you are in the above-mentioned condition, suppose that new call origination broke out from the mobile radio machine in the service area of a base transceiver station 5. In the control device which received this call request from the base transceiver station 5, giving which message channel sees the whole system, and it will examine whether it is the optimal, i.e., is a frequency deployment the highest as a system?, to a base transceiver station 5, and will perform to it. The approach is explained below. In a control device, it recognizes that the place which investigated the message channel which can be assigned in a base transceiver station 5, a message channel 2, or 4 can be assigned. Then, supposing it assigns a message channel 2, ****** effect is shown in drawing 5 (b) to the adjoining base transceiver stations 1 and 2. The semantics of this drawing is as follows.

[0042] - Even if a message channel 2 (it is ** mark all over drawing) is started to use newly in a base transceiver station 5, the usable idle message channel which generating of the interference active jamming in all the stations of base transceiver stations 1, 2, and 3 thru/or a base transceiver station 4 does not have, and each base transceiver station owns for a new call does not change unusable.

[0043] On the other hand, supposing it assigns a message channel 4, ****** effect comes to be shown in drawing 5 (c) to an adjoining base transceiver station. The semantics of this drawing is as follows.

[0044] - although there is no generating of the interference active jamming in all the offices under message until now even if a message channel 4 (it is ** mark all over drawing) is started to use newly in a base transceiver station 5 — base transceiver stations 1 and 2 — the idle message channel 4 — being unusable (* mark in drawing 5 (a) being a ** mark) — it will be influenced [of changing]. Consequently, in a base transceiver station 2, an usable message channel is completely lost and the correspondence of it in generating of a new call becomes impossible. Moreover, also in a base transceiver station 1, since the idle message channel 4 becomes unusable, unless the message channel 1 under current message becomes an idle, correspondence in generating of a new call becomes impossible.

[0045] Although the above limited with 4 the number of time slots which is an example and a radio channel has and the multiplicity was moreover set to 1, since the actual number of time slots is 8 or 16 and the multiplicity has eight channels and a large number, although it becomes more complicated than the above, the base of the method of giving a message channel is the same as that of the above. Moreover, although the example of ten or more games cannot limit the number of base transceiver stations of an actual system with five games like the above-mentioned example not few, special; consideration in a control unit is completely the same as that of this example. Thus, allocation of the message channel in a control device having big effect on the increment in capacity of the message traffic of the whole system, therefore the large thing of the role played in the improvement in the rate of a deployment of a frequency

became clear.
[0046] Furthermore, the channel assignment approach of a control device when the mobile radio machine has carried out call origination newly (or when a call in occurs to the mobile radio machine which is present in a system service area) is explained to the place which is in the condition in which the message traffic in a system is carrying out congestion. Drawing 6 shows the message situation in the service area in the case of being such. In this case, the semantics of the figure of each column is the same as that of drawing 5 (a) – (c). Namely, in all the base transceiver stations 1–5, message traffic is in a full situation and the condition of drawing 6 is in an unreceivable condition without the interference to other channels about reception of new call origination. Should a control unit receive this in such the condition or not? If it is the usual subscriber, call origination reception will be is refused (refusal by the busy tone). However, when a calling party is an important subscriber or urgency traffic, what does it carry out? In this case, although call origination reception refusal is unsuitable and reception by the compulsive clear back of other ordinary subscribers under current message is also considered, this will also allow generating of some interference active jamming of other communication links under current message not as a good plan but as the second best approach, and will carry out call origination reception. However, by the carrying–out method, this reception can also stop generating of the interference active jamming to others to the minimum, and is explained below.
[0047] The case where call origination has been newly carried out from the mobile radio machine which is present in the service area of a base transceiver station 2 is assumed. Which should a control device assign the unusable idle message channel 1 thru/or among 3? The effects to which this examination can be considered and exerts the following cases 1 and cases 2 on the whole system of that result, respectively also differ.
[0048] – Case 1 : if a message channel 1 is assigned in a base transceiver station 2, the amount of interference to a base transceiver station 1 will bring the result [amount / of interference / to a base transceiver station 3 / 30dBu(s) and] that 13dBu(s) and the amount of interference to a base transceiver station 5 have 8dBu(s) (however, actual harm is nothing since it is unusable), and no amount of interference to a base transceiver station 4.
[0049] – Case 2 : if message channels 2 or 3 are assigned in a base transceiver station 2, the amount of interference to a base transceiver station 1 will bring the result [amount / of interference / to a base transceiver station 3 / 30dBu(s) (however, since it is unusable, actual harm is nothing), and] that 13dBu(s) and the amount of interference to a base transceiver station 5 have 8dBu(s) and no amount of interference to a base transceiver station 4.
[0050] Therefore, although serious interference active jamming called 30dBu(s) is done to the communication link actually performed in the base transceiver station 1 in a case 1 in this case, in a case 2, it becomes the communication link currently performed in the base transceiver station 5 in 8dBu(s), and small interference active jamming will be done. however, the amount of interference to a base transceiver station 3 is called 13dBu(s) also with a case 1 and a case 2 – – this is unavoidable although serious interference active jamming will be done a little. Therefore, in a base transceiver station 2, it becomes optimal to assign message channels 2 or 3.
[0051] Although the above limited with 4 the number of time slots which is an example and a radio channel moreover has and the multiplicity was set to 1, since the actual number of time slots is 8 or 16 and the multiplicity has eight channels and a large number, although it becomes more complicated than the above, the base of the method of giving a message channel is the same as that of the above. Furthermore, although the example of ten or more games cannot limit the number of base transceiver stations of an actual system with five games like the above–mentioned example not few, special; consideration in a control unit is completely the same as that of this example. Thus, allocation of the message channel in a control device having big effect on the increment in capacity of the message traffic of the whole system, therefore the large thing of the role played in the improvement in the rate of a deployment of a frequency became clear.
[0052] The message channel allocation approach of the control device which fitted the message traffic condition in the system explained above with the flow chart of the system behavior which shows the method of creating drawing 1 hereafter to drawing 8 and drawing 9 with the flow chart

of the system behavior shown in drawing 7 is explained.
[0053] Drawing 7 is a flow chart for obtaining the receiving level of the electric wave between the base transceiver stations in migration communication system.
[0054] The case where it applies to the system which shows the procedure shown in drawing 7 hereafter to drawing 4 is explained as an example. Although the control unit of the system of drawing 4 and base transceiver stations 1, 2, 3, 4, and 5 have started actuation, actual systems operation still presupposes that they are not carried out. In a control unit, the signal which requests that transmission of a signal is performed with regular transmitted power level to a subordinate's base transceiver station 1 thru/or all of 5 using a common control channel by the assigned time amount timing, that the receiving level of the signal transmitted from the surrounding base transceiver station should be measured, etc. is sent (S10). In each base transceiver station 1 which received the signal from a control unit thru/or 5, while transmitting a signal by the common control channel by the time amount timing given to each, measurement of the receiving level of the signal transmitted from the surrounding base transceiver station is performed (S20). In addition, the transmitted power level of a common control channel besides ID (identification information) of a self-base transceiver station is also contained in the signal transmitted from each base transceiver station at the request of a control device.
[0055] Next, in a control unit, it is requested that the above-mentioned measurement result should be transmitted to a control unit on receiving level by the assigned time amount timing to a subordinate's base transceiver station 1 thru/or all of 5 (S30). In each base transceiver station 1 which received these directions thru/or 5, each receiving level is transmitted to a control unit by the time amount timing given to each (S40). In the control device which received base transceiver stations 1 thru/or each of such receiving level from 5, the receiving level between each base transceiver station is created and memorized (S50).
[0056] Drawing 2 is completed by the above processes and initiation of system behavior which utilized this drawing 2 , such as call origination and a call in, is attained with a control unit 10 below.
[0057] Next, there are a little many message traffic conditions in a system, and they explain system behavior when cautions are required to message channel allocation of a control device.
[0058] Drawing 8 has a little many message traffic conditions in a system, and is a flow chart which shows system behavior when cautions are required to message channel allocation of a control device. The control device of a system and many mobile radio machines which are in a service area including base transceiver stations 1, 2, 3, 4, and 5 shall already have started system behavior. The message traffic in a system presupposes that it is in the condition by which it is shown in drawing 5 (a). Suppose that new call origination was started from the mobile radio machine, and the call origination signal was sent out by the uphill control channel at this time (S210). It is received in the nearby base transceiver station 5, and this signal transmits the request signal of message channel allocation to a control device (S220). In the control device which received the message channel allocation request from a base transceiver station 5, it recognizes that it is in the condition by which it is shown by the place and drawing 5 (a) which judged the message traffic in the service area of a system, and examination of a message channel which makes drawing 2 use it for reference in a base transceiver station 5 is started (S230). Consequently, it becomes clear for a message channel 2 or 4 to be possible, without doing interference active jamming to the message channel currently used in the nearby base transceiver station. However, when a message channel 2 is given, it will be in the condition of the idle channel which the nearby base transceiver stations 1 and 2 own like already explained drawing 5 (b), but when a message channel 4 is given, since the condition of the idle channel which the nearby base transceiver stations 1 and 2 own is usable like drawing 5 (c), it turns out that it changes unusable. therefore, it is not wise to give a message channel 4 and it should give a message channel 2 — ** — it judges.
[0059] And it connects giving a message channel 2 to a base transceiver station 5 (S240). In the base transceiver station 5 which received this communication, it directs to use a message channel 2 to a mobile radio machine (S250). In a mobile radio machine, a dial signal is transmitted by the message channel 2 according to this indication signal (S260). It is received in a base

transceiver station 5, and this signal is transmitted to a control unit (S270). A control unit is transmitted to a communication network side (S280), and tells to the call-ed telephone in a communication network. However, neither a communication network nor call-ed telephone is illustrated. A setup of the transmission line between a calling party and a called party is completed in the above process, and a message will be started if a called party hangs-up telephone (S290).

[0060] Furthermore, the message channel allocation when being in the congestion condition that the message traffic in a system is shown in drawing 6 is explained.

[0061] Drawing 9 is a flow chart which shows the system behavior of message channel allocation in case the message traffic in a system is in a congestion condition. It recognizes that it is impossible to give a message channel, without doing interference active jamming to other messages, when many mobile radio machines in a service area counter, respectively, and are communicating with each base transceiver station, consequently a new call occurs in a service area in a control device. When you are in such a message traffic condition, suppose that the call request was newly advanced from the mobile radio machine in the service area of a base transceiver station 2. What does a call request carry out the case from an important subscriber newly? The flow chart of the system behavior which shows the actuation in such a case to drawing 9 explains. The control device of a system and many mobile radio machines which are in a service area including base transceiver stations 1, 2, 3, 4, and 5 have already started system behavior.

[0062] Suppose that new call origination was started from the mobile radio machine, and the call origination signal was sent out by the uphill control channel at this time (S410). It is received in the nearby base transceiver station 2, and this signal transmits the request signal of message channel allocation to a control device (S420). Although it recognizes that it is in the condition by which it is shown by the place and drawing 6 which investigated the message traffic in the service area of a system in the control device which received the message channel allocation request from a base transceiver station 2, since a calling party is an important subscriber, examination of the message channel for which allow reference some interference active jamming and drawing 2 is made to use it in a base transceiver station 2 is started.

[0063] Consequently, although it is an idle channel in a base transceiver station 2, it recognizes that unusable message channels 1 and 2 or unusable 3 exists. Among this, if which channel is given, it will be examined whether there is least interference active jamming done to communication of a nearby base transceiver station (S430). Then, when the case where a message channel 1 is given is investigated, it turns out to the adjoining base transceiver station 1 that 13dBu(s) are done to 30dBu(s) and a base transceiver station 3, and interference active jamming of 8dBu(s) is done to a base transceiver station 5. However, to a base transceiver station 5, since a message channel 1 is an unusable channel, it does not have actual harm. Subsequently, when the case where message channels 2 or 3 are given is investigated, since it is an unusable channel in a base transceiver station 1 in this case, there is no actual harm. However, it turns out that 13dBu(s) are done to a base transceiver station 3, and interference active jamming of 8dBu(s) is done to a base transceiver station 5. Comparison examination of the above result is carried out, and a conclusion that use of the message channel 1 which does serious interference active jamming of 30dBu(s) to a base transceiver station 1 is not appropriate and there are few amounts of interference active jamming of system synthesis of use of the message channels 2 or 3 which give the amount of interference active jamming of 13dBu(s) to a base transceiver station 3 to 8dBu and the base transceiver station 5 with few amounts of interference active jamming is obtained. therefore, a message channel 2 should be given — ** — it judges.

[0064] And it connects giving a message channel 2 to a base transceiver station 2 (S440). In the base transceiver station 2 which received this communication, it directs to use a message channel 2 to a mobile radio machine (S450). In a mobile radio machine, a dial signal is transmitted by the message channel 2 according to this indication signal (S460). It is received in a base transceiver station 2, and this signal is transmitted to a control unit (S470). A control unit is transmitted to a communication network side (S480), and tells to the call-ed telephone in a

communication network. However, neither a communication network nor call-ed telephone is illustrated. A setup of the transmission line between a calling party and a called party is completed in the above process, and a message will be started if a called party hangs-up telephone (S490).

[0065] As explained above, even when the message traffic in a system is in a congestion condition, call origination is received to an important subscriber, attaining minimization for the yield of the interference active jamming as much as possible in addition will raise the dependability of systems operation, approving generating of some interference active jamming ** and between [other] communication links, and it will lead to a deployment of a frequency.

[0066] In this operation gestalt, although the case where the multiplicity by the code or frequency in a message channel (time slot) was 1 was explained as an example With [a multiplicity] two [or more], there is no radio channel which is using neither of the base transceiver stations. Even if it assigns in this radio channel, even when there is no message channel which electric-wave interference does not generate, a code or a frequency is changed and electric-wave interference can be avoided by assigning a code or a frequency, and the combination of a message channel concerned.

[0067]

[Effect of the Invention] In order to correspond to the needs of the wireless use which will increase increasingly from now on, while a deployment of the further frequency is called for, the system of low cost is required. Consequently, there is an inclination performed without installation of base transceiver station arrangement having a radio-wave-propagation property top taken not much into consideration like a digital cordless telephone system. In the system by which such base transceiver station arrangement was made, interference active jamming may occur mutually between the communication links to which the communication link currently performed between the base transceiver station in the same system and the mobile radio machine if the traffic of the communication link in a service area increases is carried out between near base transceiver stations and mobile radio machines. Consequently, whenever [degradation / of communication link quality / and deployment / of a frequency] falls. On the other hand, if this invention is applied, while prevention becomes beforehand possible or the message traffic in a system is carrying out congestion of the electric-wave interference generated between [which is approached in the same system] base transceiver stations, it becomes possible by applying this invention to realize grant of a message channel to new call origination in the condition with little interference active jamming as much as possible. Consequently, improvement in communication link quality and improvement in a frequency deployment of the system by increase of the number of the coincidence message persons in a system are attained, and the effectiveness of this invention is very large.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] this invention — for example, — time-division multiplexing — carrying out — having had — a digital signal — using — migration — communication system — a base transceiver station — setting — a communication link — using it — a message channel — interference — active jamming — completely — not generating — or — or the approach and system which carry out message channel allocation with few yields — being related . Many base transceiver stations of a large number belonging to the same system exist in a service area in detail. the mobile radio machine (the terminal for migration — the outside of a mobile radio machine — a portable telephone —) with which two or more near base transceiver stations exist in each service area When performing radio good although there are another names, such as a mobile data terminal, while naming generically with a mobile radio machine below, Based on the information which carried out the collection storage of each base transceiver station in advance with the control device which carries out general management, if the same radio channel and the same time slot are assigned to the same time amount to two or more base transceiver stations, interference active jamming may be generated. While mitigating thru/or removing such interference active jamming to the maximum extent, it is related with the message channel allocation approach and system which aimed at the frequency deployment of a system.

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PRIOR ART

[Description of the Prior Art] As for mobile communication system, expansion of a service area and the rapid expansion of a user (subscriber) continue as an information communication link. A deployment of a frequency is indispensable in order to cope with the rapid increment in a subscriber. The technical solution has digitization of a signal format, and the service area of one base transceiver station is narrowed, and there is the approach of raising the rate of reuse of a frequency in a different place regarding the place. As a system which the service area of one base transceiver station made extremely narrow with the radius of about 100 meters, there is a digital cordless telephone system which uses for example, a 1.9GHz band in our country. Although it is required that the channel capacity of this whole system should be quite large, as a result of narrow-izing the service area which one base transceiver station governs, the necessary channel capacity per one base transceiver station will be mitigated considerably. However, the number of necessary base transceiver stations of having become a large number considerably contained in a system is natural.
[0003] If it explains concretely, a digital cordless telephone system will be taken for an example, for example. The base transceiver station of this system may generate interference active jamming, if a base transceiver station installation location assigns the same radio channel and the same time slot to the same time amount to two or more base transceiver stations which do not have a mutual intervention in advance and which a ** office design is not strictly carried out like, therefore distance spacing between base transceiver stations is different, consequently adjoin unlike other cellular system.
[0004] However, since there were many radio channels currently assigned to the system, electric-wave interference could be avoided with the simple technique, and a problem did not actualize. It owns the 37 radio-channel x4(slot) =148 communication channel (8 message-channel TDMA-TDD (Time Division MultipleAccess Time Division Duplex)), and, on the other hand, a communication link frequency is because 4 or 8 message-channel extent is enough as the channel capacity per one base transceiver station, i.e., the communications traffic used for coincidence. For this reason, especially in each base transceiver station, even if it does not restrict the message channel to assign and which can be communicated, interference power is supervised at any time, and correspondence of good communication link maintenance is attained by assigning a message channel with low interference level to a communication link message channel.
[0005] However, in TDMA/CDMA (Time Division Multiple Access/ Code Division MultipleAccess) which is one sort of the digital signal format adopted from a viewpoint which aims at much more frequency deployment, the problem on the following techniques will occur and it will be pressed for solution.

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EFFECT OF THE INVENTION

[Effect of the Invention] In order to correspond to the needs of the wireless use which will increase increasingly from now on, while a deployment of the further frequency is called for, the system of low cost is required. Consequently, there is an inclination performed without installation of base transceiver station arrangement having a radio-wave-propagation property top taken not much into consideration like a digital cordless telephone system. In the system by which such base transceiver station arrangement was made, interference active jamming may occur mutually between the communication links to which the communication link currently performed between the base transceiver station in the same system and the mobile radio machine if the traffic of the communication link in a service area increases is carried out between near base transceiver stations and mobile radio machines. Consequently, whenever [degradation / of communication link quality / and deployment / of a frequency] falls. On the other hand, if this invention is applied, while prevention becomes beforehand possible or the message traffic in a system is carrying out congestion of the electric-wave interference generated between [which is approached in the same system] base transceiver stations, it becomes possible by applying this invention to realize grant of a message channel to new call origination in the condition with little interference active jamming as much as possible. Consequently, improvement in communication link quality and improvement in a frequency deployment of the system by increase of the number of the coincidence message persons in a system are attained, and the effectiveness of this invention is very large.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the system using the digital signal (TDMA/CDMA) by which time-division multiplexing was carried out, by assigning a message channel to each base station per time slot, message channel quota control can be simplified and it leads to capacity increase from a viewpoint of an interference canceller technique. However, since the distance between base transceiver stations in a system is not necessarily uniform, decision of the base station which can be interfering within the same system, and the base station which does not become interference cannot be performed. Therefore, in having assigned indiscriminately as mentioned above, possibility that interference active jamming will occur becomes large, and maintenance of a good communication link becomes difficult.
[0007] Then, this invention offers the means for mitigating or removing electric-wave interference generated between [which is approached in the above-mentioned system] base transceiver stations, and improving a frequency deployment of a system.
[0008] First, each base transceiver station transmits a signal using a common control channel according to the directions from the control device which summarizes control of a system at the time of a system installation. However, a control unit specifies the base transceiver station to transmit according to time amount, and is performed so that two or more base transceiver stations may not transmit a common control channel to coincidence. According to this assignment, the signal of the transmitted common control channel is received and a self-base transceiver station number and receiving level are notified to a control device in each near base transceiver station. However, when the transmitted power of the common control channel transmitted from the base transceiver station changes with each base transceiver stations, transmitted power level is also included and transmitted to the signal of a common control channel.
[0009] Drawing 2 is drawing showing the example of the receiving level of the electric wave between the base transceiver stations in migration communication system. A control unit becomes possible [creating and memorizing the receiving level table between each base transceiver station like drawing 2] by performing the above actuation in order about each base transceiver station. In addition, the detail of this drawing 2 is mentioned later. In case a control device assigns the message channel in the same radio channel made to use it in a subordinate's base transceiver station, i.e., a certain code in a time slot, so that it may explain below, this table is used when carrying out message channel allocation without interference active jamming.
[0010] The operation at the time of applying the means explained above to a system is explained.

[0011] Although the base transceiver station will assign the message channel which should communicate with a mobile radio machine in the control device which controls this when call origination occurs from the mobile radio machine which exists in the service area of a certain base transceiver station They are the maximum requirements for communications control for not doing interference active jamming but making it not receive interference active jamming from other communication links to own communication to other communication links which are advancing to coincidence on the occasion of communication at this time conversely to maintain a good communication link.

[0012] That is, suppose that the call origination signal has transmitted using a control channel from one mobile radio machine which exists in the service area of the base transceiver station where a system belongs in the migration communication system using the digital signal by which time-division multiplexing was carried out. In the base transceiver station which received this, this information is transmitted to a control unit. In the control device which received this signal, the existence of the existence of the message channel which cannot generate interference active jamming is investigated using the operating condition of the message channel contained in each time slot in a radio channel in use and a radio channel in the nearby base transceiver station including this base transceiver station, and the table of drawing 2 memorized.
[0013] Consequently, when it has been recognized that the message channel which cannot generate interference active jamming exists, in it, the way of giving whenever [whose / frequency deployment] improves most as a system will be examined, and it will perform.
[0014] Moreover, when the message channel which cannot generate interference active jamming does not exist as a result of the above-mentioned examination, in consideration of the importance of the mobile radio machine which demanded call origination, it examines whether call origination is received. Consequently, generating of the interference active jamming done to other communication links is made into the minimum, in the case of a mobile radio machine with a high significance, the way of giving whenever [whose / frequency deployment] improves most as a system will be examined, and it will perform it.

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MEANS

[Means for Solving the Problem] Invention according to claim 1 is the migration communication system equipped with two or more base transceiver stations, and is characterized by having the channel assignment means which assigns the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.
[0016] In migration communication system according to claim 1, as for invention according to claim 2, each radio channel has two or more message channels by having two or more radio channels in a system, and said channel assignment means is characterized by assigning the message channel of the arbitration in this radio channel, when there is a radio channel which is using neither of the base transceiver stations.
[0017] As for invention according to claim 3, each radio channel has two or more message channels by having two or more radio channels in a system in migration communication system according to claim 1 or 2, and although there is no radio channel for which said channel assignment means is using neither of the base transceiver stations, when there is a message channel which is using neither of the base transceiver stations in this radio channel, it is characterized by assigning the message channel which said electric-wave interference does not generate among these message channels.
[0018] Invention according to claim 4 is set to migration communication system according to claim 1 to 3. In a system, have two or more radio channels and each radio channel has two or more message channels. Each message channel can be multiplexed or more to two with a code or a frequency. Said channel assignment means Even if it assigns in this radio channel, when there is no radio channel which is using neither of the base transceiver stations, and there is no message channel which said electric-wave interference does not generate, it is characterized by assigning the combination of the code or frequency which said electric-wave interference does not generate, and a message channel.
[0019] It is characterized by invention according to claim 5 determining the channel which assigns said channel assignment means by channel assignment in migration communication system according to claim 1 to 4 in consideration of the effect which gives the channel use by base transceiver stations other than the base transceiver station which assigns a channel.
[0020] Invention according to claim 6 is migration communication system which is the case where there is no channel in which said electric-wave interference does not generate said channel assignment means in migration communication system according to claim 1 to 5, and is characterized by said electric-wave interference to generate assigning a small channel based on the information on the electric-wave interference between said base transceiver stations when a channel needs to be assigned.
[0021] Invention according to claim 7 is characterized by the information on the electric-wave interference between said base transceiver stations being the receiving level of the electric wave at the time of transmitting and receiving a signal using a common control channel between said base transceiver stations in migration communication system according to claim 1 to 6.
[0022] Invention according to claim 8 is the channel assignment approach in the migration communication system equipped with two or more base transceiver stations, and is

characterized by assigning the channel which this electric-wave interference does not generate to the communication link of said base transceiver station based on the information on the electric-wave interference between said base transceiver stations.
[0023] According to the above configuration, in migration communication system, electric-wave interference can be reduced as much as possible, increase of subscriber capacity is achieved as a system, and offer of service of good communication link quality is attained at a user.
[0024]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained using drawing 1 - drawing 9 .
[0025] Drawing 1 is drawing showing the example of a configuration of the migration communication system (for example, digital cordless telephone system for places of business) which includes two or more base transceiver stations. In this case, four base transceiver stations 71-74 are shown, and lines are concentrated by the control unit 70 with which these have control functions, such as PBX. Each base transceiver station has service areas 171-174, the service area gathers, and the service area of a system is formed. 81-88 in drawing show a mobile radio machine (a cellular-phone (data) machine, personal digital assistant). This mobile radio machine can shift to the service areas 171-174 of other base transceiver stations freely, communicating the inside of a service area 171-174.
[0026] Drawing 2 is drawing showing the example of the receiving level of the electric wave between the base transceiver stations in migration communication system, as mentioned above. That is, the information on the existence of possibility that interference active jamming of the control unit with which each base transceiver stations 1-5 carry out multiple unit control of each base transceiver stations 1-5 beforehand between base transceiver stations will occur about the radio channel of each base transceiver stations 1-5 used for a communication link, and the measurement result of the amount of interference is reported. Although transmitted power shall be known, you may make it report in accordance with transmitted power and receiving level here. The figure of each column in drawing shows the magnitude of the amount of interference, and it is shown that the amount of interference is so large that a numeric value is large. Moreover, it is shown that a blank means that the amount of interference was not able to measure at all, and there is in interference relation. [no] In addition, for example, that the amount measured value of interference at the time of base transceiver station 1 transmission and base transceiver station 4 reception differs from the measured value at the time of base transceiver station 4 transmission and base transceiver station 1 reception shows that the measurement error in a base transceiver station 1 and a base transceiver station 4 exists. Although the same thing has an interference relation at the time of base transceiver station 5 transmission and base transceiver station 1 reception, conversely, the measured value of the amount of interference is not obtained at the time of base transceiver station 1 transmission and base transceiver station 5 reception, but this has the low effective-radiated-power level of a base transceiver station 1, and the base transceiver station 5 shows that interference active jamming has not occurred.
[0027] Drawing 3 is drawing showing the image of the example of a frame structure currently used with the migration communication system using the digital signal by which time-division multiplexing was carried out. The direction of an axis of abscissa expresses a time-axis, and the number of the time slots of one frame is 16. The direction of an axis of ordinate expresses a code or a frequency. In this drawing, the code of the direction of an axis of ordinate or the number of frequencies is 8, and shows the example by which eight message channels are multiplexed.
[0028] Drawing 4 is drawing showing the example of base transceiver station arrangement of the digital cordless telephone system for places of business. The ellipse of five pieces in drawing shows the service area of each base transceiver stations 1-5 currently installed in each center section. Each base transceiver stations 1-5 are shown by the rectangle. Although the lap of an ellipse shows that the service area has lapped by drawing 4 , the overlapping area shows that the radio signal transmitted from each base transceiver stations 1-5 which govern the area may show interference active jamming. Although not illustrated, many mobile radio machines exist in the service area of a system, and it is under a communication link or in an waiting condition.

Moreover, although this is not illustrated, either, the control unit which carries out generalization control of all the base transceiver stations 1-5 of drawing 4 is contained in the system, and it is combined in each base transceiver stations 1-5 in the transmission line. The result of already explained drawing 2 can be considered to be an example of measurement in the case of having base transceiver station arrangement like drawing 4 .

[0029] Drawing 5 is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 . That is, the message channel currently used between each mobile radio machine is displayed in the service area of each base transceiver stations 1-5.

[0030] Drawing 6 is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 at the time of traffic congestion.

[0031] Hereafter, the system of drawing 4 is explained to an example. Suppose that call origination occurred using the control channel from the mobile radio machine (not shown) which exists in the service area of a base transceiver station 1. In the base transceiver station 1 which received this, that base transceiver station starts the message channel which should communicate with a mobile radio machine, and the actuation which assigns a time slot with the control device which transmits the allocation demand signal of a communication channel to a control device and which received this signal. In this case, in a control unit, to other communication links which it is at this time and have already advanced, interference active jamming is not done but it judges whether allocation of the radio channel and time slot which do not receive interference active jamming from other communication links to the own communication of a mobile radio machine conversely is possible. It becomes the following process when the message traffic in a service area is seldom crowded.

[0032] In a control device, the existence of the existence of the radio channel which cannot generate interference active jamming in a nearby base transceiver station using a radio channel in use and a message channel in use [in a radio channel], i.e., a time slot in use and the table of drawing 2 , and a message channel is investigated. Consequently, when it has two or more radio channels in a system and there is a radio channel 2 for which message traffic is leisurely and is not used at all, the message channel 1 of the arbitration in the radio channel 2, for example, a message channel, will be assigned.

[0033] Since the radio channel 2 is not used at all in the surrounding base transceiver stations 2, 4, and 5 of a base transceiver station 1 in the above-mentioned case, even if the allocation to a base transceiver station 1 assigns the message channel of the arbitration in a radio channel 2, i.e., the time slot of arbitration, interference is not generated at all. Therefore, allocation of a time slot is easy and it is the case of being the most satisfactory.

[0034] Next, allocation of the time slot which should be a little careful of is explained. It is the case where the communications traffic near [which has carried out call origination] the mobile radio machine is a little crowded. In this case, even if it has two or more radio channels in the system, there will be no non-used radio channel. Therefore, the communication condition of the base transceiver station located in a control unit in near is not concerned how, but since the radio channel which is not in interference relation cannot be given, if the message channel which is not in interference relation within the message channel which it has within the same radio channel, i.e., which time slot, is given, that problem solving which interference active jamming does not generate will be planned.

[0035] Below, since it is easy, the wireless channel number to assign is set to 1, and the number of time slots which can be assigned within a radio channel 1 is set to 4, and the multiplicity in a time slot is set to 1. Suppose that these busy conditions were the appearance of drawing 5 (a). Although the channel is that they are usable in this if the channel's using O mark by a diagram and * mark have that the channel is un-using it, i.e., an idle channel, therefore new call origination and ** did not use it, if it is used, interference active jamming may occur to a message channel in use in an adjoining base transceiver station, and the substantially unusable thing is shown. If the condition of each base transceiver stations 1-5 of drawing 5 (a) is explained, it can express as follows.

[0036] - While a message channel 1 uses it, a message channel 4 is an idle and message

channels 2 and 3 are unusable in a base transceiver station 1.
[0037] - A message channel 4 is an idle and message channels 1, 2, and 3 are unusable in a base transceiver station 2.
[0038] - In a base transceiver station 3, while message channels 1 and 2 use it, message channels 3 and 4 are idles.
[0039] - While a message channel 2 uses it, message channels 3 and 4 are idles and the message channel 1 is unusable in a base transceiver station 4.
[0040] - While a message channel 3 uses it, message channels 2 and 4 are idles and the message channel 1 is unusable in a base transceiver station 5.
[0041] When you are in the above-mentioned condition, suppose that new call origination broke out from the mobile radio machine in the service area of a base transceiver station 5. In the control device which received this call request from the base transceiver station 5, giving which message channel sees the whole system, and it will examine whether it is the optimal, i.e., is a frequency deployment the highest as a system?, to a base transceiver station 5, and will perform to it. The approach is explained below. In a control device, it recognizes that the place which investigated the message channel which can be assigned in a base transceiver station 5, a message channel 2, or 4 can be assigned. Then, supposing it assigns a message channel 2, ****** effect is shown in drawing 5 (b) to the adjoining base transceiver stations 1 and 2. The semantics of this drawing is as follows.
[0042] - Even if a message channel 2 (it is ** mark all over drawing) is started to use newly in a base transceiver station 5, the usable idle message channel which generating of the interference active jamming in all the stations of base transceiver stations 1, 2, and 3 thru/or a base transceiver station 4 does not have, and each base transceiver station owns for a new call does not change unusable.
[0043] On the other hand, supposing it assigns a message channel 4, ****** effect comes to be shown in drawing 5 (c) to an adjoining base transceiver station. The semantics of this drawing is as follows.
[0044] - although there is no generating of the interference active jamming in all the offices under message until now even if a message channel 4 (it is ** mark all over drawing) is started to use newly in a base transceiver station 5 — base transceiver stations 1 and 2 — the idle message channel 4 — being unusable (* mark in drawing 5 (a) being a ** mark) — it will be influenced [of changing]. Consequently, in a base transceiver station 2, an usable message channel is completely lost and the correspondence of it in generating of a new call becomes impossible. Moreover, also in a base transceiver station 1, since the idle message channel 4 becomes unusable, unless the message channel 1 under current message becomes an idle, correspondence in generating of a new call becomes impossible.
[0045] Although the above limited with 4 the number of time slots which is an example and a radio channel has and the multiplicity was moreover set to 1, since the actual number of time slots is 8 or 16 and the multiplicity has eight channels and a large number, although it becomes more complicated than the above, the base of the method of giving a message channel is the same as that of the above. Moreover, although the example of ten or more games cannot limit the number of base transceiver stations of an actual system with five games like the above-mentioned example not few, special; consideration in a control unit is completely the same as that of this example. Thus, allocation of the message channel in a control device having big effect on the increment in capacity of the message traffic of the whole system, therefore the large thing of the role played in the improvement in the rate of a deployment of a frequency became clear.
[0046] Furthermore, the channel assignment approach of a control device when the mobile radio machine has carried out call origination newly (or when a call in occurs to the mobile radio machine which is present in a system service area) is explained to the place which is in the condition in which the message traffic in a system is carrying out congestion. Drawing 6 shows the message situation in the service area in the case of being such. In this case, the semantics of the figure of each column is the same as that of drawing 5 (a) - (c). that is <A HREF="/Tokujitu/tjitemdrw.ipdl?N0000=239&N0500=1E_N/;>= — < — >9>7=<>9>7= — < —

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the example of a configuration of the migration communication system which includes two or more base transceiver stations.
[Drawing 2] It is drawing showing the example of the receiving level of the electric wave between the base transceiver stations in migration communication system.
[Drawing 3] It is drawing showing the image of the example of a frame structure currently used with the migration communication system using the digital signal by which time-division multiplexing was carried out.
[Drawing 4] It is drawing showing the example of base transceiver station arrangement of the digital cordless telephone system for places of business.
[Drawing 5] It is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 .
[Drawing 6] It is drawing showing the example of the message channel currently used in each base transceiver station of drawing 4 at the time of traffic congestion.
[Drawing 7] It is a flow chart for obtaining the receiving level of the electric wave between the base transceiver stations in migration communication system.
[Drawing 8] There are a little many message traffic conditions in a system, and they are the flow charts which show system behavior when cautions are required to message channel allocation of a control device.
[Drawing 9] It is the flow chart which shows the system behavior of message channel allocation in case the message traffic in a system is in a congestion condition.
[Description of Notations]
1-5, 71-74 Base transceiver station
70 Control Unit
81-88 Mobile radio machine
101-105 Service area of a base transceiver station

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